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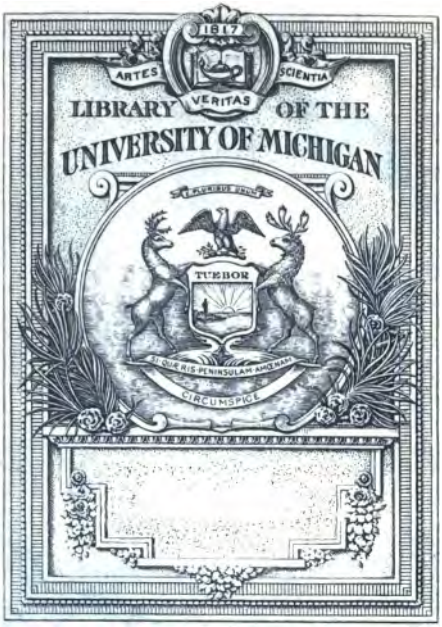
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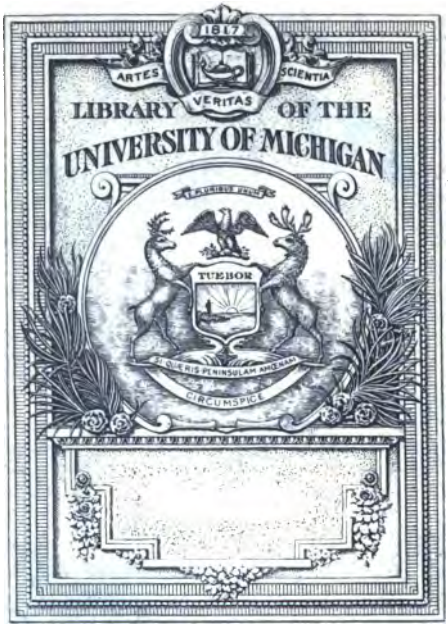
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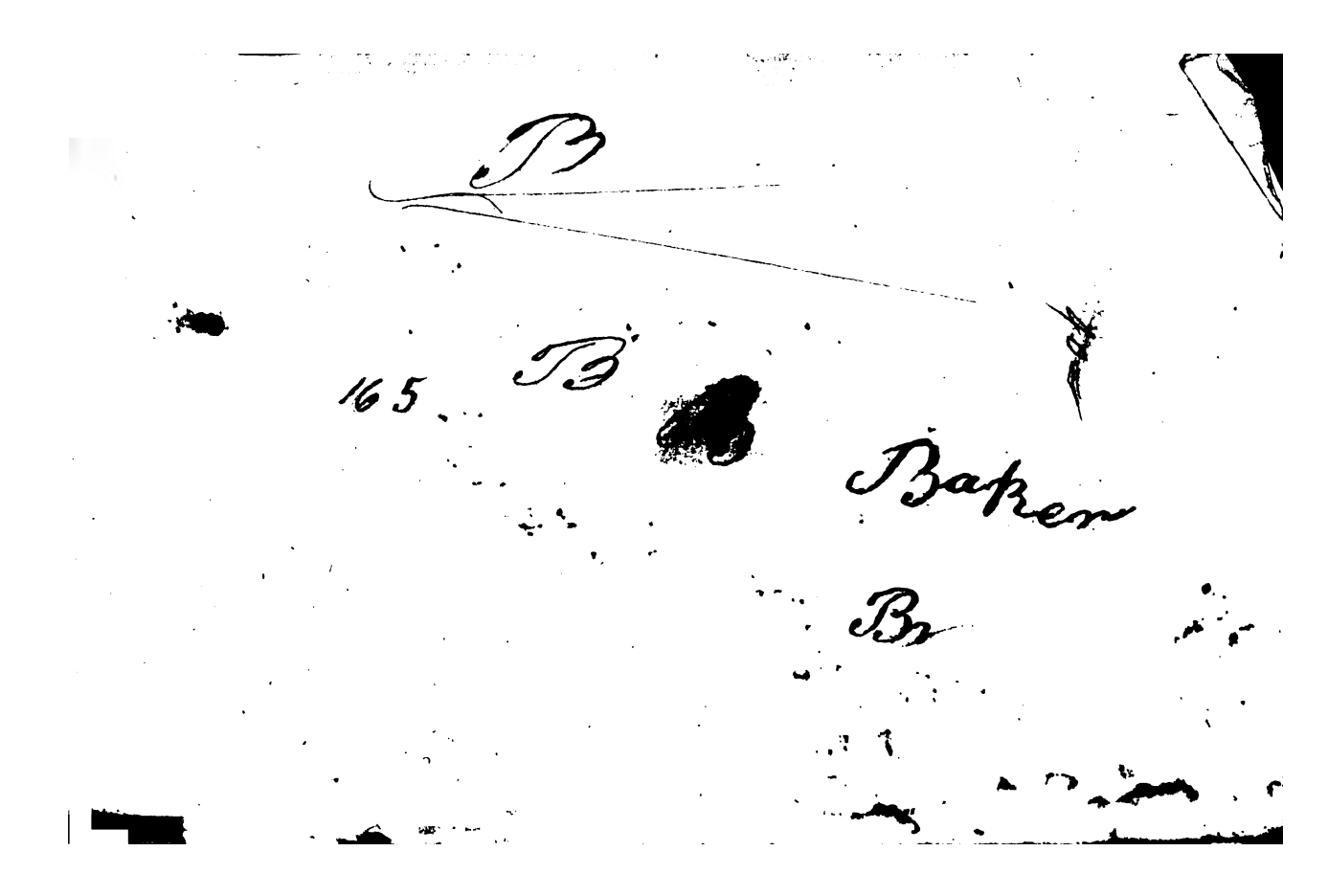
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PREFACE.

THE great Regard I have for the Practical Parts of Mathematical Sciences, particularly that which relates to Building and Ground-work, put me on Thoughts to lay down such demonstrable Rules of Arithmetick, as are suitable to the several Calculations, Measurements and Valuations, that a Person, who has learned the four first Vulgar Rules only, and has a middling Capacity, may in a short Time comprehend all that is set forth in this Treatise, without the Help of any other Teacher; which, I presume, is sufficient to carry a Man through the greatest Undertaking of this Kind.

6.25.34 Art. 7.

1. I begin with the Decimals of 10's, and shew the Working of that Rule in its four first different Parts, and compare them to those of Vulgar Arithmetick.

2. Three different Tables of Pounds, Shillings and Pence; shewing their several Decimals, with Examples how each Decimal is found.

3. Tables

3. *Tables of Perches according to the different Cuſtoms of Meaſurement in theſe Kingdoms; ſhewing the Feet they contain and their ſeveral Decimals, with Examples how they are found.*

4. *Tables of Tuns, and Loads of Timber; with thoſe of Yards and Long Hundreds, with their ſeveral Decimals, and how they are found.*

5. *The Uſes of all the foregoing Tables.*

6. *Tables for reducing Brick and Stone Walls to ſtandard Thickneſſes, according to the ſeveral Cuſtoms, with their proper Decimals and Uſes.*

7. *Duodecimals; ſhewing their Declination, Addition, Subſtraction and Multiplication, done by two Methods,* viz. *by plain Multiplication and Practice, with their ſeveral Uſes in meaſuring Superficies and Solids, demonſtrated by Inſpection.*

8. *The Meaſurement of Angles, Circles and their Segments, with Ellipſes; ſhewing the Differences between the mathematical Curve and the practical, demonſtrated by Inſpection.*

9. *To find the ſuperficial Face of a Globe and its Fruſtums, with that of a Nich,* &c. *demonſtrated by Inſpection.*

10. *Rules for finding the ſuperficial Faces of irregular and curved Figures, with Convex or Concave Dome,* &c. *of any Form, demonſtrated by proper Examples.*

11. *To*

11. *To measure an irregular Piece of Ground by the Chain only, and cast it into Acres, Roods and Perches; also to throw Links into Feet by a given Decimal, with other Rules relating thereto.*

12. *To measure and demonstrate, by Inspection, the solid Content of the Pyramid, with its Frustums both regular and irregular.*

13. *To measure and demonstrate, by Inspection, the solid Content of the Wedge and Reel in all their Shapes.*

14. *To measure and demonstrate, by Inspection, the solid Content of the Globe and its Frustums.*

15. *To demonstrate, by proper Examples, the Difference between the solid Content of a Cube, Cylinder and Globe of the same Diameter and Height, with given Decimals for the same.*

16. *To measure and demonstrate large irregular solid Bodies of Earth,* &c. *All which, I hope, will be found sufficient to perform the several Offices proposed in the former Part of this Preface.*

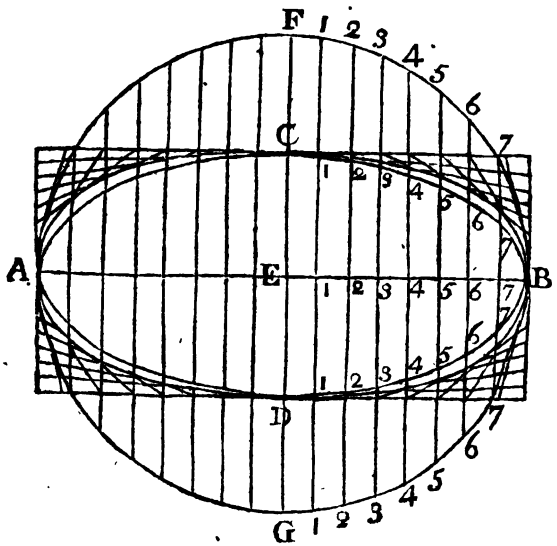
ERRATA.

PAGE 47, *Line* 5, 6 and 7, *read thus*, Parts in a Foot or Pence, or Parts in a Shilling, and diminiſhes by that Number.

P. 80, *l.* 6, below the Sum *for* Quotient, *r.* Dividend.

P. 83, *l.* 11, *for* the Fourth, *r.* the 4. *L.* 19, *for* 185, *r.* 158.

P. 88, for the Demonſtration of the Ovals (N°. 129,) ſee the following Figure.



P. 118, *l.* 3, below (N°. 167,) *for* or 6 Inches, *r.* of 6 Inches.

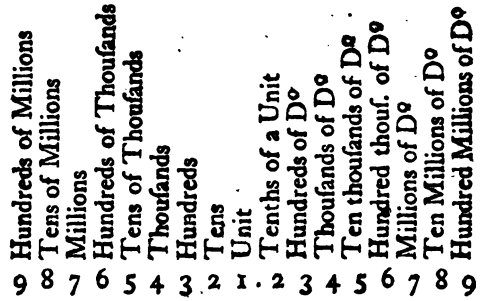
ARITH-

ARITHMETICK
AND
MEASUREMENT,
IMPROV'D.

Numeration of Decimals.

THE Numbers of this Rule decreaſe to the Right, as Whole Numbers increaſe to the Left. See Nº. 1.

(Nº. 1.)



< Whole Numbers >< Decimals. >

Obſerve to diſtinguiſh the Decimals from Whole Numbers by a Dot, as in this Example.

The Unit is called the Denominator, becauſe it is ſuppoſed to be any one Thing; as Farthing, Penny, Shilling, Pound; Inch, Foot, Yard, Perch, &c.

Suppoſe the Denominator or Unit to be an Inch, take two Whole Numbers and one Decimal thus, 21.2 is 21 Inches and $\frac{2}{10}$ of an Inch. Again, take two Whole Numbers and the ſecond Place of Decimals 21.03, which is 21 Inches and $\frac{3}{100}$ of an Inch, and ſo on; always obſerving to keep the Decimals in their proper Stations by adding Cyphers as their Place requires: For Example, .0005 is $\frac{5}{10000}$ of an Inch. Again, .0000608 is $\frac{608}{10000000}$ of an Inch; which is ſhewed more plain in the following Examples:

ADDITION of DECIMALS.

Suppoſe the Denominator to be a Foot, obſerve to place the ſeveral Decimals in their proper Stations. Thus,

(N°. 2.)

.4
.0064
.0273
.05
.75
.0000896
.9741
.00000803
.00280
2.21069763

Their Sum is 2 Feet and $\frac{21069763}{100000000}$ of a Foot.

N. B.

N. B. Theſe are added in the ſame Manner, as Whole Numbers, only with this Difference, that all the Tens which are carried to the Left of the Dots, are Whole Numbers.

ADDITION *of* MIXT NUMBERS.

Suppoſe the Denominator to be a Gallon.

	10.075
	4.007
	162.5
(N°. 3.)	18.93
	.786
	8.21
	.0005
	204.5085

Their Sum is 204 Gallons and $\frac{5085}{10000}$ of a Gallon.

SUBSTRACTION *of* DECIMALS.

It is required to ſubſtract .0025 from .5, a Yard ſuperficial being the Denominator. The latter Decimal being of the greateſt Value, muſt be placed uppermoſt, altho' it does not contain ſo many Places of Figures as the former; in this Caſe, it is not amiſs to add Cyphers to the Right in the uppermoſt Line; but it muſt be obſerved, that Cyphers, to the Right of a Decimal, do not increaſe its Value; no more than Cyphers to the Left of Whole Numbers increaſe their Sum.

(N°. 4.) .5000
.0025

.4975 Remains

N. B. This is worked in the ſame Manner, as Whole Numbers, except adding Cyphers to the upper Line.

SUBSTRACTION *of* MIXT NUMBERS.

It is required to ſubſtract .864 from 635, a Foot being the Denominator. Place the Whole Numbers in the uppermoſt Line, and add Cyphers in the Place of Decimals.

(N°. 5.) 635.000
.864

634.136 Remains

It is required to ſubſtract 42.926 from 68.247, a Shilling being the Denominator.

(N°. 6.) 68.247
42.926

25.321 Remains

MULTIPLICATION *of* DECIMALS.

Proceed as in Whole Numbers, but obſerve this General Rule, to ſeparate ſo many Figures (to the Right of the Product by a Dot) as there are Decimals in the Multiplicand and Multiplicator;

cator; and thoſe to the Left are Whole Numbers. This Rule muſt be obſerved in all Multiplication of Decimals, except one Caſe, which I ſhall ſhew hereafter. To multiply 2.5 by 2.5, a Foot being the Denominator.

2.5 Multiplicand
2.5 Multiplicator

(Nº. 7.)

125
50

6.25 Product

To multiply 27.75 by 15, an Inch being the Denominator.

27.75 Multiplicand
15 Multiplicator

(Nº. 8.)

13875
2775

416.25 Product

To multiply 724.75 by 27.25, a Perch being the Denominator.

(Nº. 9.)

724.75 Multiplicand
27.25 Multiplicator

3623 75
14495 0
507325
144950

19749.43 75 Product

To

To multiply 452 by .743, an Inch being the Denominator.

452 Multiplicand
.743 Multiplicator
(N°. 10.) ———
1356
1808
3164
———
335.836 Product

To multiply .0079 by .5, a Cube-foot being the Denominator.

.0079 Multiplicand
.5 Multiplicator
(N°. 11.) ———
.00395 Product

Obſerve, in the Multiplication of this Sum, it produces but four Places of Decimals, which is one leſs than is contained in the Multiplicand and Multiplicator, becauſe there is nothing carried from the Place of Tenths. In this and the like Caſes, there muſt be another Cypher added to the Left of the Product, as in this Example; otherwiſe it will be ten Times more than its real Value. This never happens in mixt Numbers, becauſe they naturally produce as many Figures, as there are Decimals in the Multiplicand and Multiplicator; as may be ſeen by the following Example.

To multiply 1.00095 by .6, a Gallon being the Denominator.

(N°. 12.)

1.00095 Multiplicand
.6 Multiplicator

(N°. 12.)

.600570 Product

DIVISION *of* DECIMALS.

The only Difference between this Rule and that of Whole Numbes, is only to diſtinguiſh the one from the other in the Quotient.

To divide a leſſer Number by a greater, which muſt conſequently produce no other than Decimals in the Quotient. Let it be twenty Shillings between eighty Men, as 20 cannot be divided by 80, add Cyphers to the Dividend, more or leſs, as Occaſion requires.

Dividend
Diviſor 80)20.00(.25 Quotient
160

(N°. 13.)

400
400

0

Each Man's Share is $\frac{25}{100}$ of a Shilling.

To divide 99 Feet by 16.5, add Cyphers to the Dividend, as in the foregoing Example; and obſerve this General Rule, to work ſo many Decimal Places of the Dividend, as there are Decimals in the Diviſor, and their Quotient is Whole Numbers; then make a Dot, and work the Remainder (if any) which are Decimals. See the following Examples.

Diviſor

Dividend
Diviſor 16.5)99.00(6 Quotient
990
(N°. 14.) ———
000

N.B. This Sum admits of no Remainder, therefore the Quotient is a Whole Number.

To divide 478 Feet, a Whole Number, by 16.5 a Mix'd Number. Add Cyphers to the Dividend, as before hinted.

Dividend
Diviſor 16.5)478.0000(28.969 Quotient
330
(N°. 15.) ———
1480
1320
———
1600 bring down the ſecond
1485 Cypher, and make a
——— Dot in the Quotient.
1150
990
———
1600
1485
———
115

N.B. This Sum may be work'd to Infinity, by adding a Cypher to every Period, but two or three Places of Decimals are ſufficient for any practical Buſineſs, the Remainder being of no material Value. Again, it may not be amiſs for Learners, to work the foregoing Sum, *&c.* thus,

Add no more Cyphers to the Dividend, than there are Decimals in the Diviſor, the Quotient is Whole Numbers; make a Dot to diſtinguiſh them, then add a Cypher to the Remainder (if any) and ſo on, to every new Period.

To divide a Mix'd NUMBER, by a MIX'D NUMBER.

(Nº. 16.)

Dividend

Diviſor 2.75)62.9928(22.906 Quotient

550

799

550

2492 Make a Dot in the

2475 Quotient

1780 Add a Cypher to

1650 the Quotient, and

one to the Period.

130

To divide 946527 ſuperficial Feet into Statute Perches of Land or *London* Rods of Brick-work. The Perch or Rod contains 272.25 ſuperficial Feet.

Diviſor Dividend Quotient

272.25)946527.00(3476.683

81675

129777

108900

208770

(N°. 17.) 190575

181950

163350

186000 Make a Dot in the

163350 Quotient, and add

a Cypher.

226500 Add a Cypher

217800

87000 Add a Cypher

81675

5325 Remains.

To divide WHOLE NUMBERS by DECIMALS.

Dividend

Diviſor .25)347.00(1388 Quotient

25

97

75

(N°. 18.)

220

200

200

200

0

N. B.

N. B. As there is no Remainder in this Sum, the Quotient is all whole Numbers.

To divide 647239 by .750. See the following Example.

Diviſor	Dividend	Quotient	
.750)	647239.000(	862985. 33	Multipliſicand
	6000	.750	Multiplicator
	4723	4314926650	
	4500	6040897310	
	2239	250	Remainder
	1500	647239.00000	Proof
	7390		
	6750		
	6400		
	6000		
(N°. 19.)	4000		
	3750		
	2500	Make a Dot in the Quo-	
	2250	tient, and add a Cypher	
	2500	Add a Cypher	
	2250		
	250	Remains.	

N. B. Learners may not immediately perceive, why there ſhould be two Cyphers more in the

Proof than there is in the Dividend: Anſwer, becauſe there is two added (in carrying on the Work) to give the Decimals of the Remainders: All Kinds of Diviſion may be prov'd, by multiplying the Dividend by the Diviſor, and adding the Remainder.

To find the Decimal Number of any Part or Parts of a Denominator, obſerve this General Rule: Firſt, conſider how many ſuch Parts are contained therein; then work by the Rule of Three; ſay, as ſo many Parts in the Denominator is to 100, ſo are the Parts given, to the Decimal Number requir'd. Let the Denominator be a Foot, and the Decimal Number of 9 Inches be requir'd; ſay, as

In. Parts Inches
12 = 100 = 9

9
12)900(.75 Decimal requir'd
84 12
— —
(N°. 20.) 60 150
60 75
———
(0) .900 Proof

N. B. This anſwers the ſame, to the Pence in a Shilling; and obſerve, that in the ſame Manner as this Example is prov'd, is the General Rule for finding the Value of any Decimal; as I ſhall ſhew hereafter: But there is one Caution may be proper to be given, which is the finding the Decimal of Number 1: Obſerve this General Rule, Add a Cypher to the Left of the Quotient,

Quotient, otherwiſe it will appear to be 10 Times more than its real Value. Suppoſe 12 be the Denominator. See the following Examples:

12 = 100 = 1
1

12)100(.83
96
(N°. 21.) 40
36
4

N. B. This Example proves (N°. 21.) to be 10 Times more than its real Value, becauſe it's impoſſible that one of 12, ſhould be equal to 83 of 100. This is cauſed, by Figure 1 admitting no Figures to be carried to the Left, which is the Caſe of (N°. 11.) therefore a Cypher muſt be added to the Left of the Quotient, and it will give the Decimal thus, .083; and ſo of Number 1, in all Denominations: Or, it may be work'd thus.

12=100=01
01

100
000

(N°. 22.) 12)0100(.083
96

40
36

4

The

The following Table ſhews the Decimal Numbers of all the Inches in a Foot, or Pence in a Shilling.

Foot or Shilling	Pence or Inches		Decimals
	12		100
	11		.916
	10		.833
	9		.75
(N°. 23.)	8		.666
	7		.583
	6	is	.5
	5		.416
	4		.333
	3		.25
	2		.166
	1		.083

To find the Decimal of any Number of Quarters in an Inch, or Farthings in a Penny, let two Quarters be given.

(N°. 24.)

4 = 100 = 2

2

(N°. 24.) 4)200(.5 Decimal

20

0

The following Table ſhews the Decimal Numbers of all the Quarters in an Inch, or Farthings in a Penny.

(N°. 25.)

Quarters or Farthings of Inch or Penny		Decimals
4		100
3		.75
2	is	.5
1		.25

To find the Decimal Sum of any Number of Shillings in a Pound, let 13 Shillings be given.

20 = 100 = 13

13

(N°. 26.) 300

100

20)1300(.65 Decimal

120

100

100

0

The

The following Table ſhews the ſeveral Decimal Sums of all the Numbers of Shillings in a Pound.

A Pound	Shillings	Decimal
	20	100
	19	·95
	18	.9
	17	.85
	16	.8
	15	·75
	14	·7
	13	.65
	12	.6
	11	·55
(N°. 27.)	10 is	·5
	9	·45
	8	·4
	7	·35
	6	·3
	5	.25
	4	.2
	3	.15
	2	.1
	1	.05

A Perch of Brick, or Stone-Wall, in many Places of *Great-Britain* and *Ireland*, contains 16.5 ſuperficial Feet; to find the Decimal of any Number of Feet contain'd therein: Let 12 Feet be given.

16.5

16.5 = 100 = 12

12

200

(N°. 28.) 100

16.5) 1200.0 (.727 Decimal

1155

450

330

1200 Add a Cypher

1155

45

The following Table shews the several Decimal Sums of any Number of Feet in a Perch of 16.5 superficial Feet.

	Feet	Decimals
A Perch	16.5	100
	16	.969
	15	.909
	14	.848
	13	.787
(N°. 29.)	12	.727
	11	.666
	10	.606
	9	.545
	8	.484
	7	.424
	6	.363
	5	.303
	4	.242
	3	.181
	2	.121
	1	.06

In ſome Places of *Great Britain* 18 ſuperficial Feet is a Perch of Brick or Stone-Wall. To find the ſeveral Decimals of any Number of Feet contained therein: Let 5 Feet be given.

18 = 100 = 5

5

18)500(.277

36

140

(N°. 30.) 126

140 Add a Cypher

126

14

The following Table ſhews the ſeveral Decimal Sums of every Number of Feet, contained in a Perch of 18 ſuperficial Feet.

	Feet	Decimals
A Perch	18	100
	17	.944
	16	.888
(N°. 31.)	15	.833
	14	.777
	13	.722
	12	.666
	11	.611
	10	.555

A Perch

Feet	Decimals
9	.5
8	.444
7	.388
6	.333
5	.277
4	.222
3	.166
2	.111
1	.055

In many Places, eſpecially in ſome Parts of the North of *England*, and Weſt of *Ireland*, a Perch of Brick or Stone-Wall, is 21 ſuperficial Feet, and is called Plantation Meaſure. To find the ſeveral Decimals of every Number of Feet contained therein: Let 8 Feet be given.

21 = 100 = 8

8

21)800(.38 Decimal

(N°. 32.) 63

170

168

2

The following Table ſhews the Decimal Sums of the ſeveral Feet, contained in a Perch of 21 ſuperficial Feet.

A Perch (N°. 33.)

Feet		Decimals
21		100
20		.95
19		.9
18		.85
17		.8
16		.76
15		.71
14		.66
13		.61
12		.57
11		.52
10		.47
9		.42
8		.38
7		.33
6		.28
5		.23
4		.19
3		.14
2		.09
1		.04

A *London* Perch or Rod of Brick-Wall is 16.5 Feet ſquare, equal to a Statute Perch of Land, which contains 272.25 ſuperficial Feet.

To

To find the ſeveral Decimals of every Number of Feet contain'd therein, let 105 Feet be given.

272. 25 = 100 = 105

105

500
1000

272. 25)10500.00(.385 Decimal
8167 5·

2332 50
2178 00

1545 00 Add a Cypher
(N°. 34.) 1361 25

18375 Remains

The following Table ſhews the Decimal Sums of the ſeveral Feet contain'd in a Statute Perch of Land, or *London* Rod of Brick-Wall.

	Feet	Dls.	Feet	Dls.	Feet	Dls.
Rod	272.25	100	261	.958	249	.914
	272	.999	260	.955	248	.91
	271	.995	259	.951	247	.907
	270	.991	258	.947	246	.903
	269	.988	257	.943	245	.899
(N°.35.)	268 is	.984	256 is	.94	244 is	.896
	267	.98	255	.936	243	.892
	266	.977	254	.932	242	.888
	265	.973	253	.929	241	.885
	264	.969	252	.925	240	.881
	263	.966	251	.921	239	.877
	262 is	.962	250	.918	238	.874

Feet	Dls.	Feet	Dls.	Feet	Dls.
237	.87	194	.712	151	.554
236	.866	193	.708	150	.55
235	.863	192	.705	149	.547
234	.859	191	.701	148	.543
233	.855	190	.697	147	.539
232	.852	189	.694	146	.536
231	.848	188	.69	145	.532
230	.844	187	.686	144	.528
229	.84	186	.683	143	.525
228	.837	185	.679	142	.521
227	.833	184	.675	141	.517
226	.83	183	.672	140	.514
225	.826	182	.668	139	.51
224	.822	181	.664	138	.506
223	.819	180	.661	137	.503
222	.815	179	.657	136	.499
221	.811	178	.653	135	.495
220	.808	177	.65	134	.492
219	.804	176	.646	133	.488
218	.8	175	.642	132	.484
217	.797	174	.639	131	.481
(N°.35.) 216	is .793	173	is .635	130	is .477
215	.789	172	.631	129	.473
214	.786	171	.628	128	.47
213	.782	170	.624	127	.466
212	.778	169	.62	126	.462
211	.775	168	.617	125	.459
210	.771	167	.613	124	.455
209	.767	166	.609	123	.451
208	.764	165	.606	122	.448
207	.76	164	.602	121	.444
206	.756	163	.598	120	.44
205	.752	162	.595	119	.437
204	.749	161	.591	118	.433
203	.745	160	.587	117	.429
202	.741	159	.583	116	.426
201	.738	158	.58	115	.422
200	.734	157	.576	114	.418
199	.73	156	.573	113	.415
198	.727	155	.569	112	.411
197	.723	154	.565	111	.407
196	.719	153	.561	110	.404
195	.716	152	.558	109	.4

Feet	Dls.	Feet	Dls.	Feet	Dls.
108	.396	72	.264	36	.132
107	.393	71	.26	35	.128
106	.389	70	.257	34	.124
105	.385	69	.253	33	.121
104	.382	68	.249	32	.117
103	.378	67	.246	31	.113
102	.374	66	.242	30	.11
101	.37	65	.238	29	.106
100	.367	64	.235	28	.102
99	.363	63	.231	27	.099
98	.359	62	.227	26	.095
97	.356	61	.224	25	.091
96	.352	60	.22	24	.088
95	.348	59	.216	23	.084
94	.345	58	.213	22	.08
93	.341	57	.209	21	.077
92	.337	56	.205	20	.073
(N°.35.) 91 is	.334	55 is	.202	19 is	.069
90	.33	54	.198	18	.066
89	.326	53	.194	17	.062
88	.323	52	.191	16	.058
87	.319	51	.187	15	.055
86	.315	50	.183	14	.051
85	.312	49	.179	13	.047
84	.308	48	.176	12	.044
83	.304	47	.172	11	.04
82	.301	46	.168	10	.036
81	.297	45	.165	9	.033
80	.293	44	.161	8	.029
79	.29	43	.157	7	.025
78	.286	42	.154	6	.022
77	.282	41	.15	5	.018
76	.279	40	.146	4	.014
75	.275	39	.143	3	.011
74	.271	38	.139	2	.007
73	.268	37	.135	1	.003

To find the ſeveral Decimals of any Number of Feet contained in a ſuperficial Yard, let 7 Feet be given.

9=100=7

7

9)700(.777 Decimal

(N°. 36.) 63

70

63

70 Add a Cypher

63

7

The following Table ſhews the Decimal Sums of the ſeveral Feet contained in a ſuperficial Yard.

	Feet		Decimals
A Yard	9		100
	8		.888
	7		.777
	6		.666
(N°. 37.)	5	is	.555
	4		.444
	3		.333
	2		.222
	1		.111

In moſt Places of *Great Britain*, and *Ireland*, (except in and about *London*) Timber is bought and

and ſold by what is called a Tun, which is 40 Cube Feet. To find the ſeveral Decimals of any Number of Feet contained therein, let 13 Feet be given.

40=100=13
13
300
100
40)1300(.325 Decimal
120
100
80
200 Add a Cypher
200
0

(N°. 38.)

The following Table ſhews the Decimal Sums of the ſeveral Feet contain'd in a Tun of Timber.

	Feet	Decimals	Feet	Decimals
A Tun	40	100	31	.775
	39	.975	30	.75
	38	.95	29	.725
	37	.925	28	.7
(N°.39.)	36 is	.9	27 is	.675
	35	.875	26	.65
	34	.85	25	.625
	33	.825	24	.6
	32	.8	23	.575

	Feet	Decimals		Feet	Decimals
	22	.55		11	.275
	21	.525		10	.25
	20	.5		9	.225
	19	.475		8	.2
	18	.45		7	.175
(N°. 39.)	17 is	.425		6 is	.15
	16	.4		5	.125
	15	.375		4	.1
	14	.35		3	.075
	13	.325		2	.05
	12	.3		1	.025

In and about *London*, Timber is bought and sold by the Load, which contains 50 Cube Feet: To find the several Decimals of any Number of Feet contained therein, let 32 Feet be given.

50=100=32

32

(N°. 40.) 200

300

50)3200(.64 Decimal

300

200

200

0

The following Table shews the Decimal Sums of the several Feet contain'd in a Load of Cube Timber.

Feet	Dls.	Feet	Dls.	Feet	Dls.
A Load 50	100	33	.66	16	.32
49	.98	32	.64	15	.3
48	.96	31	.62	14	.28
47	.94	30	.6	13	.26
46	.92	29	.58	12	.24
45	.9	28	.56	11	.22
44	.88	27	.54	1	.2
43	.86	26	.52	9	.18
(N°.41.) 42 is	.84	25 is	.5	8 is	.16
41	.82	24	.48	7	.14
40	.8	23	.46	6	.12
39	.78	22	.44	5	.10
38	.76	21	.42	4	.08
37	.74	20	.4	3	.06
36	.72	19	.38	2	.04
35	.7	18	.36	1	.02
34	.68	17	.34		

The Uſe of the foregoing Table is to find the Value of the ſeveral Parts of a Perch, Yard, Tun, Load, *&c.* for Example: Suppoſe a Perch of Brick-Wall of 16.5 ſuperficial Feet coſt 7*s.* 4*d.* What is the Value of 17 Perch and 7 Feet? Look in N°. 27 for the Decimal of 4*d.* and the Money will ſtand thus, 7.333; then look in (N°. 29.) for the Decimal of 7 Feet, and the Work will ſtand thus, 17.424. See the following Example.

	17.424	Work
	7.333	Money *per* Perch
(N°. 42.)	52 272	
	522 72	
	5227 2	
	121 96 8	
Shillings	127).770192	
	12	Pence in a Shilling
	1 540384	
	7 70192	
Pence	9).242304	
	4	Farthings in a Penny
	.969216	

The whole Value appears to be 127*s.* 9*d.* (and almoſt a Farthing remains) which is 6*l.* 7*s.* 9*d.*

Throw Shillings into Pounds, by cutting off the Unit, and halving the Figures to the Left, thus,

	s.	*d.*		
	12 | 7	9	}	The Sums of N°. 40.
(N° 43.)	*l.*	*s.* *d.*		
	6	7 9		

Again, let 137*s.* be given, cut off the Unit and halve the 13; ſay the half of 13 is 6 and 1 remains equal to 10*s.* which muſt be carried to the Place of Shillings, the Sum will ſtand thus,

6*l.* 17 0.	13 | 7			Shillings
(N°. 44.)	*l.*	*s.*	*d.*	
	6	17	0	Sum in Pounds.

If

If it ſhould be aſk'd why this Rule throws Shillings into Pounds? Anſwer, Becauſe all the Figures to the Left of the Place of Units are Tens, conſequently half their Sum muſt be Twenties, except the remaining 1, which is 10*s.* and muſt be carried to its proper Place.

A Perch of 16.5 Feet being the Denominator: To know the Value of 13 Feet at 7*s.* 3*d.* *per* Perch, look in (N°. 23.) for the Decimal of 3*d.* and the Money will ſtand thus, 7.25; then look in (N°. 29.) for the Decimal of 13 Feet, and the Work will ſtand thus, .787

	7.25	Money
	.787	Work
	5075	
	5800	
	5075	
Shillings	5.705.75	
	12	Pence in a Shilling
(N°. 45.)	1 211 50	
	6 057 5	
Pence	7.269 00	
	4	Farthings in a Penny
Farthings	1.076 00	

The Value of 13 Feet appears to be 5 Shillings and 7 Pence Farthing.

To know the Value of 75 Yards, 5 Feet, of Wainſcot at 4*s.* 8*d.* *per* Yard. Look in (N°. 37.)

(N°. 37.) for the Decimal of 5 Feet, and the Work will ſtand thus, 75.555. Then look in (N°. 23.) for the Decimal of 8 *d.* and the Money will ſtand thus, 4.666

	75.555	Work
	4.666	Money
(N°. 46.)	453 330	
	4 533 30	
	45 333 0	
	302 220	
Shillings	352.539 630	
	12	Pence in a Shilling.
	1 079 260	
	5 396 30	
Pence	6.475 560	
	4	Farthings in a Penny.
Farthings	1.902 240	

	s.	*d.*
The Value appears to be	35	2 $6\frac{1}{4}$
(N°. 47.) or £.	17	12 $6\frac{1}{2}$

To know the Value of 764 Yards, and 7 Feet of Plaiſtering at $3d\frac{1}{2}$ *per* Yard. Look in (N°. 37.) for the Decimal of 7 Feet, the Work will ſtand thus, 764.777: Then look in (N°.25.) for the Decimal of a $\frac{1}{2}$, and the Money will ſtand thus, 3.5

(N°. 48.)

	764.777	Work
	3.5	Money
(N°. 48.)	3823885	
	2294331	
Pence	2676.719 5	
	4	Farthings in a Penny
Farthings	2.8780	

The Sum appears to be (N°. 49.)

	d.	
	2676 —	½
	s.	
or	22 | 3	0½
or	£. 11 3	0½

To know the Value of 42 *London* Rod, and 137 Feet of Brick-Wall, at 6*l.* 14*s. per* Rod, look in (N°. 35.) for the Decimal of 137 Feet, and the Work will ſtand thus, 42.503; then look in (N°. 27.) for the Decimal of 14*s.* and the Money will ſtand thus, 6.7.

	42.503	Work
	6.7	Money
	297521	
	255018	
Pounds	284.770 1	
	20	Shillings in a Pound
Shillings	15.402 0	
	12	Pence in a Shilling
(N°. 50.)	8040	
	4020	
Pence	4.824 0	
	4	Farthings in a Penny
Farthings	3.296 0	

The

The Value appears to be 284*l.* 15*s.* 4*d*¾.

N. B. By applying to the proper Tables, the ſeveral Meaſurements of a Building may be caſt up, and the Value of the minuteſt Part found; but, obſerve, there is no Table in this Work for the Meaſure, call'd a Square, which contains 100 ſuperficial Feet, becauſe every Number of Feet contain'd therein, are naturally ſo many Decimal Parts of the Denominator.

To know the Value of 15 Square 63 Feet of Roofing at 2*l.* 9*s. per* Square: The Feet being Decimals cauſes the Work to ſtand thus, 15.63; then look into (N°. 27.) for the Decimal of 9*s.* and the Money will ſtand thus, 2.45.

	15.63	Work
	2.45	Money
	78 15	
	6252	
	3126	
Pounds	38.29 35	
	20	Shillings in a Pound
Shillings	5.87 00	
	12	Pence in a Shilling
(N°. 51.)	1 74 00	
	8 70 0	
Pence	10.44 00	
	4	Farthings in a Penny
Farthings	1.76 00	

The

The Value appears to be 38*l.* 5*s.* 10*d.* $\frac{1}{4}$.

N. B. So work as Decimals, every Number of Feet contained in a Square.

The general Rule to find the Value in Meaſure, and Money of any Decimal (as is hinted in *N. B.* (N°. 20.) is as follows: Firſt, to conſider what Parts the Denominator is commonly divided into, as a Pound into Shillings, a Shilling into Pence, a Penny into Farthings; a Perch Square or Yard into Feet, and a Foot, Gallon or Buſhel into Inches: Theſe are the general Parts they are made up of in the common Courſe of Buſineſs; but a Perſon may throw them into any other Parts as he ſhall think proper, which does not alter the Nature of working the Numbers.

Suppoſe .5 of a Wine Gallon be given; to know how many Cube Inches it contains, Multiply the Number of Inches in a Gallon (which is 231) by the Decimal, the Content is the Inches required.

	231	Inches in a Gallon
N°. 52.)	.5	Decimal
	115.5	Inches required

Suppoſe a Gallon of Wine coſt 8*s.* 4*d.* What is the Value of .5 of a Gallon? Look in (N°. 23.) for the Decimal of 4*d.* and the Price of the Gallon of Wine ſtands thus, 8.333, which multiply by the given Decimal, the Content is the Value required.

	8.333	Coſt of a Gallon
	.5	Decimal
Shillings	4.1665	
	12	Pence in a Shilling
(N°. 53)	3330	
	1665	
Penny	1.9980	
	4	Farthings
Farthings	3.9920	

The Value requir'd is 4*s*. 1¼, and $\frac{9920}{10000}$ of a Farthing.

Here may be ſeen the ſmall Defect in Decimal Arithmetick, becauſe a Gallon coſt 8*s*. 4*d*. The Decimal .5 being half the Quantity muſt coſt 4*s*. 2*d*. So there is $\frac{80}{10000}$ of a Farthing wanting; becauſe the Decimal of 4*d*. when the Denominator is 12, cannot be work'd to a Period. So it is in many other Decimal Numbers: However, the Difference is ſo ſmall from Truth, that they are uſed by the greateſt Mathematicians in moſt of their Calculations.

Let the Decimal .525 of a Statute Perch of Land, or *London* Rod of Brick-Wall be given; to know how many ſuperficial Feet it contains. The Perch or Rod is 272.25 Feet, which multiply by the given Decimal, the Content is the Feet required.

(N°. 54.)

	272.25	Perch
	.525	Decimal
	136125	
(N°. 54.)	54450	
	136125	
Feet	142.93125	
	12	Inches in a Foot
	11.86250	
	93125	
Inches	11.17500	

The Decimal contains 142 Feet 11 Inches, and .17500 of an Inch remains

Suppoſe a *London* Rod of Brick-Wall coſt 6*l.* 12*s.* What does .525 of a Rod coſt? Look in (N°. 27.) for the Decimal of 12, and the Money will ſtand thus, 6.6; which multiply by the given Decimal .525, their Product is the Value required

	.525	Decimal
	6.6	Money
	3150	
	3150	
Pounds	3.4650	
	20	Shillings in a Pound
Shillings	9.3000	
	12	Pence in a Shilling
(N°. 55.)	6000	
	3000	
Pence	3.6000	
	4	Farthings in a Penny
Farthings	2.4000	

The Value appears to be 3*l.* 9*s.* 3 $\frac{1}{4}$

The following Table ſhews the Decimals of the ſeveral Numbers in a long Hundred of Five-ſcore and Twelve.

Pounds	Dls.	Pounds	Dls.	Pounds	Dls.
112	100	74	.66	37	.33
111	.991	73	.651	36	.321
110	.982	72	.642	35	.312
109	.973	71	.633	34	.303
108	.964	70	.625	33	.294
107	.955	69	.616	32	.285
106	.946	68	.607	31	.276
105	.937	67	.598	30	.267
104	.928	66	.589	29	.258
103	.919	65	.58	28	.25
102	.91	64	.571	27	.241
101	.901	63	.562	26	.232
100	.892	62	.553	25	.223
99	.883	61	.544	24	.214
98	.875	60	.535	23	.205
97	.866	59	.526	22	.196
96	.857	58	.517	21	.187
95	.848	57	.508	20	.178
(N°.56.) 94	is .839	56	is .5	19	is .169
93	.83	55	.491	18	.16
92	.821	54	.482	17	.151
91	.812	53	.473	16	.142
90	.803	52	.464	15	.133
89	.794	51	.455	14	.125
88	.785	50	.446	13	.116
87	.775	49	.437	12	.107
86	.767	48	.428	11	.098
85	.758	47	.419	10	.089
84	.75	46	.41	9	.08
83	.741	45	.401	8	.071
82	.732	44	.392	7	.062
81	.723	43	.383	6	.053
80	.714	42	.374	5	.044
79	.705	41	.366	4	.035
78	.696	40	.357	3	.026
77	.687	39	.348	2	.017
76	.678	38	.339	1	.008
75	.669				

The

The following Table ſhews the Decimals of the ſeveral Numbers in a long Hundred of Six-ſcore.

Pounds	Dls.	Pounds	Dls.	Pounds	Dls.
120	100	80	.666	40	.333
119	.991	79	.658	39	.325
118	.983	78	.65	38	.316
117	.975	77	.641	37	.308
116	.966	76	.633	36	.3
115	.958	75	.625	35	.291
114	.95	74	.616	34	.283
113	.941	73	.608	33	.275
112	.933	72	.6	32	.266
111	.925	71	.591	31	.258
110	.916	70	.583	30	.25
109	.908	69	.575	29	.241
108	.9	68	.566	28	.233
107	.891	67	.558	27	.225
106	.883	66	.55	26	.216
105	.875	65	.541	25	.208
104	.866	64	.533	24	.2
103	.856	63	.525	23	.191
102	.85	62	.516	22	.183
(N°.57.) 101 is	.841	61	.508	21	.175
100	.833	60 is	.5	20 is	.166
99	.825	59	.491	19	.158
98	.816	58	.483	18	.15
97	.808	57	.475	17	.141
96	.8	56	.466	16	.133
95	.791	55	.458	15	.125
94	.783	54	.449	14	.116
93	.775	53	.441	13	.108
92	.766	52	.433	12	.1
91	.758	51	.425	11	.091
90	.75	50	.416	10	.083
89	.741	49	.408	9	.075
88	.733	48	.4	8	.066
87	.725	47	.391	7	.058
86	.716	46	.383	6	.05
85	.708	45	.375	5	.041
84	.7	44	.366	4	.033
83	.691	43	.358	3	.025
82	.683	42	.35	2	.016
81	.675	41	.341	1	.008

Of

Of reducing Brick and rough Stone-Walls into three ſeveral cuſtomary Thickneſſes.

In and about *London*, Brick-Walls are generally reduced to 14 Inches, but in moſt other Parts to 9 Inches. I have known [illegible] Perſons to reduce them to 18 Inches, but the latter brought as a cuſtomary [illegible]

The ſeveral Thickneſſes for rough are 18 Inches, 20 Inches, and [illegible] have known ſeveral Diſputes [illegible] three laſt Articles, which makes it [illegible] nominate the Thickneſs of the inte[illegible] ducement before the Work begins.

The Following Table ſhews the Decimals of the ſeveral Inches contained in a 9 Inch Brick-Wall.

(N°. 58.)

Inches		Decimals of a long Inches
9		[illegible]
8		.88
7		.77
6		.66
5	is	.55
4		.44
3		.33
2		.22
1		.11

Let 7642 Feet of Brick-Wall 24 Inches thick be given, it's required to know how many Feet of 9 Inches thick, that Sum produces. Take the 9's out of the Thickneſs for whole Numbers, and 6 remains; then look in (N°. 58.) for the

the Decimal of 6, and the Sum will ſtand thus, 2.66. Which multiply by the given Feet, their Product is the Sum of Feet required.

7642	Feet
2.66	Thickneſs
45852	
45852	
15284	
20327.72	
12	Long Inches in a Foot
144	
72	

The Content required is 20327 Feet, 8 long Inch. 96 remains; this laſt is of too ſmall a Value to be accounted for.

N. B. Obſerve this general Rule in all Reducements: When the ſeveral Dimenſions are thrown into Feet, draw out all that are of one Thickneſs into ſeparate Columns, and reduce their Sums into one propoſed Thickneſs, before they are divided into Perches.

Suppoſe a Dimenſion is 520 Feet and 8 Inches thick (as it ſometimes happens in Breaks of Chimnies, &c.) it's required to know how many Feet of 9 Inches thick are contained therein. Look into (N°. 58.) for the Decimal of 8 Inches,

ches, which multiply by 520 Feet, their Sum is the Feet required.

	520	Feet
	.88	Decimal
(N°. 60.)	4160	
	4160	
Feet requir'd	457.60	
	12	
	120	
	60	
Long Inches ditto	7.20	

The Sum required is 457 Feet, 7 long Inches and .20 remains.

N. B. When the Thickneſs happens to be ſo many 9's and no Remainder, take no Notice of the Table of Decimals, but multiply the Sum of Feet by their Number; or if the given Sum be one Brick and a half thick, add its Half to the Whole, the Sum is the Number of Feet, at 9 Inches thick.

The following Table ſhews the Decimals of the ſeveral Inches contained in a 14.5 Inches, or one Brick and a half Wall.

Inches

(N°. 61.)

Inches	Decimals
14.5	100
14	.965
13	.896
12	.827
11	.758
10	.689
9	.62
8	.551
7	.482
6	.413
5	.344
4	.275
3	.2
2	.137
1	.069
½	.034

Let 11749 Feet of Brick-Wall 52 Inches thick be given; to know how many Feet of 14.5, of Brick and a half Wall is contained therein: Take 3 Times 14.5 from 52, which is 43.5 Inches for whole Numbers, and 8.5 Inches remains; then look in (N°. 61.) for the Decimal of 8 Inches, and that of ½ an Inch, and add the two together, the Sum of the Thickneſs will ſtand thus, 3.585: Which multiply by the given Number 11749, their Product is the Sum of Feet required.

	11 749	Feet
	3.585	Thickneſs
	58 745	
(N°. 62.)	91 92	
	5874 5	
	35247	
Feet requir'd	41272.165	
	12	Long Inches in a Foot
	330	
	1 65	
Long Inch ditto	1.980	

The requir'd Sum is 41272 and 1 Long Inch, and $\frac{165}{1000}$ of an Inch remains.

N. B. Obſerve in this as was mentioned in *N. B.* (N°. 60.) where the Thickneſs of the Wall contains ſo many Bricks breadth, and no odd Inches remains: The foregoing Table is of no Uſe; but work thus, Let 746 Feet of Wall 2 Bricks thick be given; to know how many Feet of 1 Brick and $\frac{1}{2}$ Wall that Sum will produce; take 1 Brick and $\frac{1}{2}$ out of the Thickneſs, and $\frac{1}{2}$ a Brick remains equal to $\frac{1}{3}$ of the Whole; therefore add $\frac{1}{3}$ of the given Sum to itſelf, and it produces the Number of Feet requir'd.

	746	The given Sum
	248.66	One 3d. of ditto
(N°. 63.)	994.66	The Sum required

N. B. If the Thickneſs be 2 Bricks and $\frac{1}{2}$ thick, add $\frac{1}{5}$ of the given Sum to itſelf. If 3 Bricks, double the given Sum, and ſo on.

The

The following Table ſhews the ſeveral Decimals in a Stone-Wall of 18 Inches thick.

(N°. 64.)

Inches		Decimals
18		100
17		.94
16		.88
15		.83
14		.77
13		.72
12		.66
11		.61
10		.55
9	is	.5
8		.44
7		.38
6		.33
5		.27
4		.22
3		.16
2		.11
1		.05

Let 24967 Feet of Stone-Wall 32 Inches thick be given; to know how many Feet of 18 Inch-Wall that Sum will produce; take 18 Inches the propoſed Thickneſs (for a whole Number) and 14 remains: Then look into (N°. 64.) for the Decimal of 14 Inches, and the Sum of Thickneſs will ſtand thus, 1.77: Which multiply with the given Sum, their Product will be the Number of Feet requir'd.

	249 67	Given Sum
	1.77	Thickneſs
	1747 69	
(N°. 65.)	17476 9	
	24967	
Feet required	44191.59	

The following Table ſhews the ſeveral Decimals in a Stone-Wall of 20 Inches thick.

Inches		Decimals
20		100
19		.95
18		.9
17		.85
16		.8
15		.75
14		.7
13		.65
12		.6
11		.55
10	is	.5
9		.45
8		.4
7		.35
6		.3
5		.25
4		.2
3		.15
2		.1
1		.05

(N°. 66.)

Let

Let 346324 Feet of Stone-Wall 49 Inches thick be given; to know how many Feet of 20 Inch Wall that Sum will produce. Take 40 from the Thickneſs and 9 will remain: Then look in (N°. 66.) for the Decimal of 9 Inches, and the Sum of Thickneſs will ſtand thus, 2.45, which multiply by the given Number, gives the Sum requir'd.

	346324	Given Sum
	2.45	Thickneſs
(N°. 67.)	1731620	
	1385296	
	692648	
Feet required	848493.80	

The following Table ſhews the ſeveral Decimals in a Stone-Wall of 24 Inches thick.

	Inches	Decimals	Inches	Decimals
	24	100	12	.5
	23	.95	11	.45
	22	.91	10	.41
	21	.87	9	.37
	20	.83	8	.33
(N°. 68.)	19 is	.79	7 is	.29
	18	.75	6	.25
	17	.7	5	.2
	16	.66	4	.16
	15	.62	3	.12
	14	.58	2	.08
	13	.54	1	.04

Let

Let 34604 Feet of Stone-Wall 103 Inches thick be given; to know how many Feet of 24 Inch-Wall that Sum will produce: Firſt, ſee how many 24's in 103, ſay 4 and 7 Inches remains. Then look into (N°. 68.) for the Decimal of 7 Inches, and the Sum of Thickneſs will ſtand thus, 4.29, which multiply by the given Number, their Product is the Sum required.

	34604	Given Sum
	4.29	Thickneſs
(N°. 69.)	311436	
	69208	
	138416	
Feet requir'd	148451.16	

Again, let 4623 Feet of Stone-Wall 17 Inches thick be given; to know how many Feet of 24 Inch-Wall it will produce: Look in (N°. 68.) for the Decimal of 17 Inches, which multiply by the given Feet, their Product is the Sum requir'd.

	4623	Given Sum
(N° 70.)	.7	Decimal
Feet requir'd	32361	

Of DUODECIMALS.

The only Uſe of this Rule is to throw Inches and Parts into Feet, and Pence into Shillings, and is generally uſed by Maſter-Builders and Meaſurers in ſquaring their ſeveral Dimenſions,

ſions, and judg'd by moſt to be the beſt Method for that Purpoſe.

The Denominator, or Unit, in this Rule, is divided into 12's, which repreſent the Inches and Parts in a Foot, or Pence and Parts in a Shilling, divided into a Foot or Shilling, and diminiſhes by that Number till it brings the Sum to a Period, which cannot be done by Decimals of 10's, except the Numbers bear a Proportion to the 4ths of a 100.

Obſerve, 1 ſuperficial Foot contains 12 Long Inches, 1 Long Inch 12 Short Inches, 1 Short Inch is divided into 12 Parts, 1 of thoſe 12 into 12 Parts, and ſo on till there is no Remainder. See the following Example, which ſhews the Value of every Place of Figures to the 1728th Part of a ſuperficial Inch.

	Feet	Parts	2ds	3ds	4ths	5ths
(N°. 71.)	1	1	1	1	1	1
	Foot	Long Inch	Short Inch	12 of Short Inch	144 of Short Inch	1728 of Short Inch

ADDITION of DUODECIMALS.

Stop at 12's in all the Parts, and at 10's in the Feet: This muſt be obſerved as a general Rule in all Sums work'd by Duodecimals.

Feet

(Nº. 72.)

	Feet	Parts	2ds	3ds	4ths	5ths
	12	7	6	3	9	2
	19	2	5	4	0	7
	29	6	5	3	0	0
	00	0	7	0	8	9
	14	4	2	9	2	6
	03	2	9	3	3	0
Feet	79	0	0	0	0	0

Again, see the following Example.

(Nº. 73.)

	Feet	Parts	2ds	3ds	4ths	5ths
	29	4	0	7	6	1
	4	0	6	5	1	9
	13	8	2	4	0	6
	15	9	0	0	7	3
	1	5	3	6	1	8
	36	0	0	9	5	4
	1	1	1	1	1	1
	48	0	0	0	0	0
	0	0	0	7	6	5
	149	4	3	5	6	1
	Feet	Long Inches	Short Inches	12's of Short Inches	144's of Short Inches	1728's of Short Inches

SUB-

SUBSTRACTION *of* DUODECIMALS.

Obſerve to place the Sum of the greateſt Value in the upper Line, and place Cyphers where there are no Parts.

To ſubſtract Shillings, Pence and Farthings from Shillings and Pence.

(N°. 74.)

	s.	d.	2ds
	47	6	0
	9	9	6
	37	8	6
	Shillings	Pence	¼ a Penny

N. B. Obſerve this general Rule in all Money Sums work'd by Duodecimals, to ſet in the Place of 2ds the Figure 3 for a Farthing, 6 for a Half-penny, and 9 for three Farthings; becauſe they are ſo many 12's of a Penny: The ſame Sum will anſwer for ſo many Feet and Parts.

To ſubſtract Feet and Parts, from Feet and Parts.

	Feet	Parts	2ds	3ds	4ths	5ths	
	90	11	7	0	6	2	
(N°. 75.)	23	5	6	9	3	10	
	67	6	0	3	2	4	Remains
	Feet	Long Inches	Short Inches	12's of Short Inches	144's of Short Inches	1728's of Short Inches	

Say, 10 from 14 and 4 remains; carry 1 to 3 is 4, from 6 and 2 remains; 9 from 12 and 3 remains; carry one to 6 is 7, from 7 and 0 remains; 5 from 11 and 6 remains; 3 from 10 and 7 remains; carry 1 to 2 is 3, from 9 and 6 remains.

To ſubſtract Feet and Parts from Feet.

	Feet	Parts	2ds	3ds	4ths	
	907	0	0	0	0	
(N°. 76.)	29	7	10	0	11	
	877	4	1	11	1	Remains
	Feet	Long Inches	Short Inches	12's of Short Inches	144's of Short Inches	

Say,

Say, 11 from 12 and 1 remains; carry 1 from 0 and 11 remains; carry 1 to 10 is 11, from 12 and 1 remains; carry 1 to 7 is 8, from 12 and 4 remains; carry 1 to 9 is 10, from 17 and 7 remains; carry 1 to 2 is 3, from 10 and 7 remains; carry 1 from 9 and 8 remains.

MULTIPLICATION *of* DUODECIMALS.

This Rule is call'd by ſome Croſs Multiplication, becauſe the Parts are work'd by the Feet croſs-ways. There are two Methods of working theſe Dimenſions, and both are uſeful to be known (which I ſhall ſhew in the following Examples;) but the moſt ready for large Dimenſions, is that done by the Rule of Practice, which is a Kind of Diviſion mixed with Multiplication; but before a Learner proceeds, he muſt be acquainted with the equal Parts of 12, as followeth.

(N°. 77.)

	Inches	Parts
	1	$\frac{1}{12}$
	2	$\frac{1}{6}$
Equal Parts of	3	is $\frac{1}{4}$ a Foot or Shilling
	4	$\frac{1}{3}$
	6	$\frac{1}{2}$

Theſe are equal Parts, but the following are odd Numbers, which muſt be taken in Pieces thus: Take 4 which is equal to $\frac{1}{3}$ from 5 and 1 remains equal to $\frac{1}{12}$; again, take 6 equal to $\frac{1}{2}$ from 7 and 1 remains equal to $\frac{1}{12}$; again, take 4 equal to $\frac{1}{3}$ from 8 and the ſame remains; again, take 6 equal to $\frac{1}{2}$ from 9 and 3 remains equal to $\frac{1}{4}$; again, take 6 equal to $\frac{1}{2}$ from 10 and 4 re-

mains equal to $\frac{1}{3}$; again, 11 cannot be taken at twice, but muſt be divided into three Parts, take 6 equal to $\frac{1}{2}$ and 5 remains, then take 4 equal to $\frac{1}{3}$ and 1 remains equal to $\frac{1}{12}$; but 9 and 11 may be work'd a ſhorter Way, as I ſhall ſhew in the proper Examples.

(N°. 78.)

	Inches		Parts		
Unequal Parts of 8 Divided into	5	$\frac{1}{3}$	$\frac{1}{12}$		a Foot or Shilling equal Parts
	7	$\frac{1}{3}$	$\frac{1}{4}$		
	9	$\frac{1}{3}$	$\frac{1}{4}$		
	10	$\frac{1}{3}$	$\frac{1}{3}$		
	11	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{12}$	

is and

N. B. I ſhall ſet an Example of every Number of Inches in a Foot, in order to ſhew the Work more diſtinct for the Benefit of Learners; and begin with 2, 3, and ſo proceed.

To know the Content of 8 Feet 3 Inches, by 5 Feet 2 Inches.

(N°. 79.)

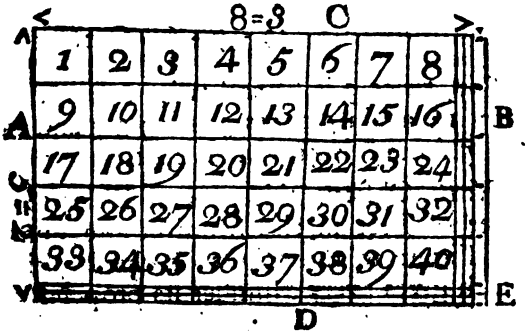
8	-		
5	-	2	
40			
1	3		
1	4	6	
42	7	6	Content
Feet	Long Inches	Short Inches	

First,

First, multiply Feet by Feet, then 5 Feet by 3 Inches, because 3 is ¼ of 12, say the 4's in 5 is 1 Foot and 1 remains equal to 3 Long Inches; then 8 Feet by 2 Inches, because 2 is ⅙ of 12, say the 6's in 8 is 1 Foot and 2 remains equal to 4 Long Inches; then multiply Inches by Inches, say twice 3 is 6 Short Inches, where the Product of Inches by Inches amounts to 12 or upwards, the 12's are Long Inches, and the Remainder is Short Inches. This Rule is demonstrated by the following double Scale of Feet and Inches, which is adapted to the Example.

A double Scale representing the foregoing Example.

(Nº. 80.)



Demonstrations, see (Nº. 80.) The Number of Feet are 40, because the Side A contains 5 Feet, the Side B contains 5 Places of 3 Long Inches equal to 1 Foot 3 Long Inches; again, because the Side C contains 8 Feet, the Side D contains 8 Places of 2 Long Inches equal to 1 Foot, 4 Long Inches; this proves the Necessity of working cross-ways, the Corner E is 6 Short Inches, which would be lost if Inches be not multiplied by Inches.

As I ſaid before in the Introduction of Multiplication, that there were two Methods of working this Rule, which I ſhall ſhew by the two following Examples; and, I think, the latter is beſt adapted for ſmall Dimenſions, where the Multiplication can be done by Head.

To work 8 Feet 3 Inches, by 5 Feet 2 Inches, by Multiplication of 12's.

	8 - 3	Multiplicand
	5 - 2	Multiplicator
(N°. 81.)	1 4 6	
	41 3	
	42 - 7 - 6	Content

Say, twice 3 is 6, and twice 8 is 16, a 4 and carry 1; again 5 times 3 is 15 a 3 and carry 1, and 5 times 8 is 40 and 1 is 41.

N. B. Obſerve this general Rule, to ſet the Place of Feet in the Multiplicator, under the laſt Figure to the Right of the Multiplicand, which gives every Number its proper Place.

This is an excellent Rule for meaſuring ſmall Dimenſions, both ſuperficial and ſolid, as Marble Slabs, Blocks, *&c.* of which I ſhall ſet down ſome few Examples, before I proceed with the Rule of Practice.

To know the Content of 6 Feet 3 Inches and $\frac{1}{2}$, by 4 Feet 7 Inches and $\frac{1}{4}$.

(N°. 82.)

6 - 3 - 6 Multiplicand
4 - 7 - 3 Multiplicator

(N°. 82.)

	1	6	10	6
3	8	0	6	
25	2	0		
28	11	7	4	6
Feet	Long Inches	Short Inches	12's of Short Inches	144's of Short Inches

Say, 3 times 6 is 18, a 6 and carry 1, and 3 times 3 is 9 and 1 is 10, and 3 times 6 is 18 a 6 and carry 1; then 7 times 6 is 42 a 6 and carry 3, and 7 times 3 is 21 and 3 is 24 an 0 and carry 2, and 7 times 6 is 42 and 2 is 44 an 8 and carry 3; again 4 times 6 is 24 an 0 and carry 2, and 4 times 3 is 12 and 2 is 14 a 2 and carry 1, and 4 times 6 is 24 and 1 is 25.

To know the Content of 4 Feet 9 Inches, by 10 Inches and ½.

4 - 9 Multiplicand
0 - 10 - 6 Multiplicator

(N°. 83.)

	2	4	6
3	11	6	
4	1	10	6

Say,

Say, 6 times 9 is 54 a 6 and carry 4, and 6 times 4 is 24 and 4 is 28 a 4 and carry 2; then 10 Times 9 is 90 a 6 and carry 7, and 10 times 4 is 40 and 7 is 47 a 11 and carry 3.

To know the Content of 7 Feet 0 Inches and ¼, by ¼ of an Inch.

(N°. 84.)

7	- 0	- 9			Multiplicand
		0	- 0	- 9	Multiplicator
	6	3	6	9	
	0	0	0		
0	0	0			
0	6	3	6	9	Content
Feet	Long Inches	Short Inches	12's of Short Inches	144's of Short Inches	

To know the Content of 12 Feet, by 7 Inches and ¼.

(N°. 85.)

12				Multiplicand
0	- 7	- 3		Multiplicator
	3	0		
7	0			
7	- 3	- 0		Content
Feet	Long Inches			

To

To know the Content of a Block 6 Feet 4 Inches and ½ long, 4 Feet 5 Inches and ¼ wide, and 3 Feet 2 Inches and ¼ deep.

	6	4	6		Length
		4	5	3	Breadth
(N°. 86.)	1	7	1	6	
2	7	10	6		
25	6	0			
28	3	5	7	6	Superficial Content
			3	2	3 Depth
	7	0	10	4	10 6
4	8	6	11	3	0
84	10	4	10	6	
90	2	0	8	1	10 6
Cube Feet	Great Cube Inches	Long Cube Inches	Cube Inches	12's of Cube Inches	144's of Cube Inches	1728's of Cube Inches

N. B. The Great Inch is 144 Cube Inches, and the Long Inch is 12 ditto.

The two laſt Figures to the Right, in the ſuperficial Content, may be thrown away being of ſmall Value, but was work'd in the Example,

ample, to ſhew that this Rule brings all Dimenſions to a Period.

Of Large Dimenſions done by the RULE *of* PRACTICE.

To know the Content of 3 Feet 1 Inch, by 15 Feet 2 Inches.

(N°. 87.)

31 — 1
15 — 2

0 - 2
5 - 2
1 - 3
155
31

471 - 5 - 2 Content

Feet | Long Inches | Short Inches

Firſt, Multiply Inches by Inches; ſay, twice 1 is 2 Short Inches; then 2 Inches by 31 Feet, becauſe 2 is $\frac{1}{6}$ of a Foot, ſay the 6's in 31 is 5 Feet and 1 remains equal to 2 Long Inches; then 15 Feet by 1 Inch, becauſe 1 Inch is $\frac{1}{12}$ of a Foot, ſay the 12's in 15 is 1 Foot and 3 Long Inches remains, then multiply Feet by Feet.

To know the Content of 76 Feet 3 Inches, by 39 Feet 4 Inches.

(N°. 88.)

76 - 3
× 39 - 4

1

(N°. 88.) 25 - 4
9 - 9
684
228

2998 - 2 Content

Multiply Inches by Inches, ſay 4 times 3 is 12 equal to 1 Long Inch, then 76 Feet by 4 Inches, becauſe 4 Inches is $\frac{1}{3}$ of a Foot, ſay the 3's in 7 is 2, and the 3's in 16 is 5 Feet and 1 remains equal to 4 Long Inches; then 39 Feet by 3 Inches, becauſe 3 Inches is $\frac{1}{4}$ of a Foot, ſay the 4's in 39 is 9 Feet and 3 remains equal to 9 Long Inches; then multiply Feet by Feet.

To know the Content of 764 Feet 5 Inches by 429 Feet 6 Inches.

764 - 5
× 429 - 6

2 - 6
382 - 0 - 0
143 - 0 - 0
(N°. 89.) 35 - 9
6876
1528
3056

328316 - 11 - 6 Content

Multiply Inches by Inches, ſay 6 times 5 is 30, equal to 2 Long Inches and 6 Short ones remain; then 764 Feet by 6 Inches, becauſe 6 Inches is ½ a Foot, ſay the ½ of 7 is 3, the ½ of 16 is 8, and the ½ of 4 is 2 and 0 remains; then 429 Feet by 5 Inches, becauſe 5 is no equal Part of a Foot: Work by 4, that being ¼ of a Foot, ſay the 3's in 4 is 1, the 3's in 12 is 4, and the 3's in 9 is 3; then by 1 Inch, ſay, the 12's in 42 is 3, the 12's in 69 is 5 and 9 Long Inches remain; then multiply Feet by Feet.

To know the Content of 94 Feet 7 Inches, by 83 Feet 8 Inches.

(N° 90.)

94 - 7
83 - 8

4 - 8
31 - 4
31 - 4
41 - 6
6 - 11
282
752

7913 - 5 - 8 Content.

Multiply Inches by Inches, ſay 8 times 7 is 56, the 12's in 56 is 4 Long Inches, and 8 Short ones remain; then 94 Feet by 8 Inches, becauſe 8 is no equal Part of 12; work by 4 twice repeated, ſay the 3's in 9 is 3, the 3's in 4 is 1 and 1 remains equal to 4 Long Inches; ſo again, then 83 Feet by 7 Inches, becauſe 7

is

is no equal Part of 12, work by 6, ſay the ½ of 8 is 4, the ½ of 3 is 1; and ½ remains equal to 6 Long Inches; then by 1, ſay the 12's in 83 is 6 and 11 Long Inches remain; then multiply Feet by Feet.

To know the Content of 37 Feet 9 Inches, by 23 Feet 10 Inches.

(N°. 91.)

37 - 9
23 - 10

7 - 6
18 - 6
12 - 4
11 - 6
5 - 9
111
74

899 - 8 - 6 Content

Say, 10 times 9 is 90, the 12's in 90 is 7 Long Inches and 6 ſhort ones remain; then 37 Feet by 10 Inches, becauſe 10 is no equal Part of 12, work by 6 and 4: Say, the ½ of 3 is 1, the ½ of 17 is 8 and ½ remains equal to 6 Long Inches; then by 4, ſay, the 3's in 3 is 1, the 3's in 7 is 2 and 1 remains equal to 4 Long Inches; then 23 Feet by 9 Inches, becauſe 9 is no equal Part of 12, work by 6 and 3, ſay, the ½ of 2 is 1, the ½ of 3 is 1 and ½ remains equal to 6 Long Inches; then by 3, ſay, the 4's in 23 is 5 and 3 remains equal to 9 Long Inches: Or thus; ſay, the ½ of 23 Feet is 11 and 6 Long

Long Inches, and the ½ of 11 Feet 6 Long Inches is 5 Feet 9 Long Inches, becauſe 3 is the ½ of 6, therefore its Product muſt be ſo in Proportion; then multiply Feet by Feet.

To know the Content of 32 Feet 11 Inches by 18 Feet.

32 - 11
18 - 0

9
6
1 - 6
256
32

592 - 6

(N°. 92.)

Work 18 Feet by 11 Inches, becauſe 11 is no equal Part of 12, work by 6, 4 and 1, ſay, the ½ of 18 is 9; then by 4, ſay the 3's in 18 is 6; then by 1, ſay the 12's in 18 is 1 and 6 Long Inches remains: Or thus; take 18 Inches from 18 Feet, and 16 Feet 6 Long Inches remain for the Content; then multiply Feet by Feet.

To know by the Rule of Practice the Content of 16 Foot 3 Inches and ½, by 14 Foot 7 Inches and ¼.

Firſt, Obſerve Parts of Inches by Parts of Inches, the 12's are 12's of Short Inches, and the Remainders are 144's of Short Inches; Parts of Inches by Inches, the 12's are Short Inches, and the Remainder is 12's of Short Inches; Parts of Inches by Feet, the 12's are Long Inches, and the Remainder is Short Inches; again, Inches by

by Inches, the 12's are Long Inches and the Remainder is Short Inches; again, Inches by Feet, the 12's are Feet and the Remainder is Long Inches. See the following Example.

(N°. 93.)

			16	-	3	-	6				
			14	-	7	-	3				
								0	-	1	- 6
								0	-	9	
					4	-	0				
					0	-	3	-	6		
		0	-	1	-	9					
		8	-	0							
		1	-	4							
		0	-	7							
		3	-	6							
	64										
	16										
	237	-	11	-	1	-	4	-	6		
	Feet		Long Inches		Short Inches		12's of Short Inches		144's of Short Inches		

N. B. Carry on the Work as the croſs Lines direct; begin with 2ds by 2ds, ſay, 3 times 6 is 18 equal to $\frac{1}{8}$ of a Short Inch, and $\frac{6}{144}$ of the ſame; then

then 2ds by Parts, ſay 3 times 3 is $\frac{9}{12}$ of a Short Inch; then Feet by 2ds, ſay the 4's in 16 are 4 Long Inches; then Inches by Parts, ſay the $\frac{1}{2}$ of 7 is 3 Short Inches and $\frac{6}{12}$; then Inches by Inches, ſay 7 times 3 is 21 equal to 1 Long Inch and 9 Short Inches; then 16 Feet by 7 Inches, ſay the $\frac{1}{4}$ of 16 is 8, and the 12 in 16 is 1 Foot 4 Long Inches; then 14 Feet by 6 Seconds, ſay the $\frac{1}{4}$ of 14 is 7 Long Inches; then 14 Feet by 3 Inches, ſay the 4's in 14 is 3 Feet and 2 remains equal to 6 Long Inches; then multiply Feet by Feet.

To know the ſolid Content of a Piece of Timber 25 Feet long, Scantling 1 Foot 3 Inches, by 1 Foot 2 Inches.

(N°. 94.)

1 - 3	Breadth
1 - 2	Depth
2 - 6	
1 - 3	
1 - 5 - 6	
25	Feet Long
1 - 0 - 6	
8 - 4	
2 - 1	
25	
36 - 5 - 6	Content

Say, twice 3 is 6, and twice 1 is 2, then once 3 is 3, and once 1 is 1; again by the Length 25 Feet, ſay the $\frac{1}{2}$ of 25 is 12 equal to 1 Foot, and 6 Long Inches remain equal to $\frac{1}{4}$ a Great Inch or 72 Cube Inches; then 25 Feet by 5 Inches, ſay the 3's in 25 is 8 Feet and

and 1 remains equal to 4 Great Inches; then the 12's in 25 is 2 Feet and 1 Great Inch remains; then Feet by Feet.

See the ſame Dimenſion the common Way.

15 } Inches
14 }
60
15
210
25 Feet Long
1050
420
144)5250(36 Feet
432
930
(N°. 95.) 864
66
12 Great Inches in a Foot
132
66
144)792(5 Great Inches
720
72
12 Long Inches in a Great Inch
144
72
144)864(6 Long Inches
864
0

So the Content is 36 Feet, 5 Great Inches and 6 Long Inches.

To know the Content of a Piece of Timber, 31 Feet 6 Inches Long, Scantling 1 Foot 5, by 1 Foot 5.

(N°. 96.)

1 - 5 -	}	Scantling
1 - 5	}	
7 - 1		
1 - 5		
2 - 0 - 1		
31 - 6		Length
1 - 0 - 0 - 6		
0 - 2 - 7		
62		
63 - 2 - 7 - 6		Content

Feet - Great Inches - Long Inches - Cube Inches

Say, 5 times 5 is 25 a 1 and carry 2, and 5 times 1 is 5 and 2 is 7; then once 5 once 1; then 6 times 1 is 6 and 6 times 0 is 0, and 6 times 2 is 12 a 0 and carry 1; again, 31 by 1, the 12's in 31 is 2 Great Inches and 7 Long Inches remains; then Feet by Feet.

See the ſame Dimenſion the common Way.

17 } Inches
17 }
119
17
289
31 - 6 Feet Long
144 - 6
289
867
144)9103 - 6(63 Feet
864
463
432
31 - 6 Remainder
12 Great Inches in a Foot
(N°. 97.) 62
316 The 6 Inches are added
144)378(2 Great Inches
288
90
12 Long Inches in a Great Inch
180
90
144)1080(7 Long Inches
1008
72
12 Cube Inches in a Long Inch
144
72
144)864(6 Cube Inches
864
0

The Content is 63-2-7-6. See (N°.96.)

To know the ſolid Content in Yards of a Cellar, 33 Feet 4 Inches Long, 25 Feet 6 Inches Wide, and 7 Feet 9 Inches Deep.

33 — 4
25 — 6

0 - 2
16 - 6
8 - 4
165
66

(N°. 98.) 849 — 0
7 — 9 Depth

424 - 6
212 - 3
5943 Yards Feet Inches
27)6579 - 9(243 - 18 - 9
54
117
108
99
81
18 - 9 Remains

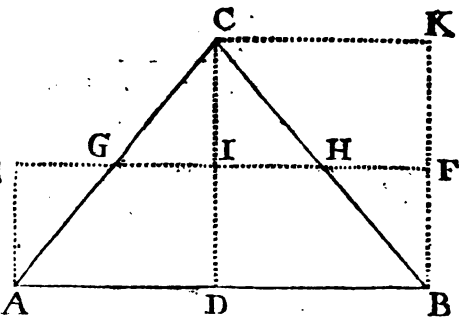
Firſt, multiply Inches ~~by~~ Inches; ſay, the ½ of 4 is 2; then 33 Feet by 6 Inches, ſay the ½ of 3 is 1, the ½ of 13 is 6 and 6 Long Inches remains; then 25 Feet by 4 Inches, the 3's in

25 is 8 and 1 remains equal to 4 Long Inches; then Feet by Feet: Again, work 849 Feet by 9 Inches, becauſe 9 is no equal Part of 12, work by 6 and 3, ſay the $\frac{1}{3}$ of 8 is 4, the $\frac{1}{2}$ of 4 is 2, the $\frac{1}{2}$ of 9 is 4 and 6 Great Inches remains; then the $\frac{1}{2}$ of 424 Feet 6 is 212 Feet 3 Inches; then Feet by Feet, and divide by 27 for Cube Yards.

Of the MEASUREMENT *of* ANGLES.

Obſerve this Rule in the Meaſurement of all Angles: Multiply the whole Baſe by $\frac{1}{2}$ the Perpendicular, or the whole Perpendicular by $\frac{1}{2}$ the Baſe. See the following Demonſtration.

(N°. 99.)



See Fig. (N°. 99.) The Line EF is equal and parallel to the Baſe AB, and cuts the Perpendicular CD in the Middle at I, becauſe the Angle CIG is equal to the Angle GEA, and the Angle CIH to the Angle HFB; therefore the Parallelogram AEFB is equal to the Angle ACB, which proves the whole Baſe by $\frac{1}{2}$ the Perpendicular to be the true Meaſure of the given Angle ACB; again, the Perpendicular CD

cuts

cuts the whole Angle and Baſe in the Middle, and the Line BK is equal and parallel to CD, and the Angle CKB is equal to the Angle BDC or CDA, and the Parallelogram, CKBD muſt be equal to the given Angle ACB; which alſo proves that the whole Perpendicular, by ½ the Baſe, gives the true Meaſure of the given Angle ACB.

To know the Content of an Angle whoſe Baſe is 8 Feet 4 Inches, and its Perpendicular 5 Feet 2 Inches.

	8 - 4	Whole Baſe
	2 - 7	Half Perpendicular
(N°. 100.)	4 - 10 - 4	
	16 - 8	
	21 - 6 - 4	Content

Feet | Long Inches | Short Inches

Or thus,	5 - 2	Whole Perpendicular
	4 - 2	Half Baſe
	10 - 4	
(N°. 101.)	20 - 8	
	21 - 6 - 4	Content

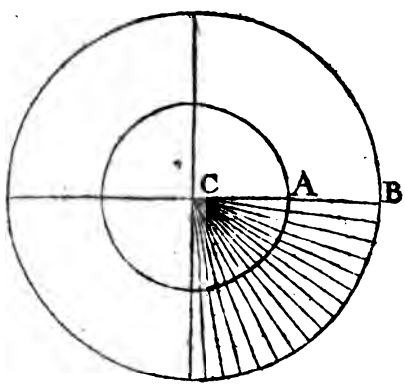
Of

Of the MEASUREMENT *of* CIRCLES.

Obſerve this general Rule: Multiply $\frac{1}{2}$ the Circumference by $\frac{1}{2}$ the Diameter, or the whole Circumference by $\frac{1}{4}$ of the Diameter. Demonſtration: A Circle contains an infinite Number of Angles tending to the Center, whoſe Baſe is the Circumference, and $\frac{1}{2}$ the Diameter their Perpendicular.

See (N°. 102.) Becauſe the Circumference B is their Baſe, and AB $\frac{1}{2}$ of the Diameter is $\frac{1}{2}$ their Perpendicular CB, the whole Circumference multiplied by $\frac{1}{2}$ of the Diameter proves to be the Meaſure of the Circle; again, $\frac{1}{2}$ the Circumference or Baſe B multiplied by CB, the whole Perpendicular or $\frac{1}{2}$ Diameter proves, alſo, that $\frac{1}{2}$ the Circumference, by $\frac{1}{2}$ the Diameter gives the ſame Content or Meaſure. See (N°. 99.) for the Demonſtration of Angles.

(N°. 102.)



The next Thing to be conſidered, is to find the Length of the Circumference by a given Diameter;

Diameter; which in common Practice is, As the Diameter 7 is to 22 the Circumference, ſo is the given Diameter to the required Circumference; and it muſt be obſerved, that the Length of Curves, and moſt other mathematical Proportions cannot ſo well be found by Duodecimals as by Decimals of 10's; therefore I ſhall execute moſt of the following Examples by the latter Rule.

Let the Diameter of a Circle be 14 Feet; to know the Circumference, work by the Rule of 3, ſay as 7 is to 22, ſo is 14 the given Diameter to the Circumference required.

7 = 22 = 14

14

(N°. 103.) 88

22

7)308(44 Circumference

To know the Content of a Circle whoſe Diameter is 14 Feet.

22 Half Circumference

(N°. 104.) 7 Half the Diameter

154 Content

Or thus, 44 Whole Circumference

3·5 One 4th of the Diameter

(N°. 105.) 220

132

154.0 Content

An-

Another RULE *to Meaſure a* CIRCLE.

Let the Diameter be the ſame as above, ſquare the Diameter and multiply the Product by 11 and divide by 14, the Quotient is the Content of the Circle required.

14 } Diameters
14 }

56
14

196 Content of Diameter
11

(N°. 106.) 196
196

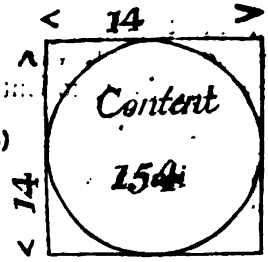
14)2156(154 Content
14

75
70

56
56

0

(N°. 107.)



Content of Square 196

It may be aſk'd from whence theſe Proportions derive? Anſwer, The Content of the Circle is to the Square of the Diameter, as 11 is to 14. For Example, a Square whoſe Sides are 14 contains 196, and a Circle whoſe Diameter is 14 contains 154, as in the foregoing Example, which to prove, divide the two Contents each by 14, the Quotient of the former will be 14, and the Quotient of the latter 11. See the two following Examples.

(N°. 108.)

14)196(14
14
—
56
56
—
0

(N°. 109.)

14)154(11
14
—
14
14
—
0

Theſe

Theſe Examples ſhew the Derivation of the Numbers 11 and 14; but the Reaſon of their Application is thus, The Content of the Diameters Square, See (N°. 107.) is ſuppoſed to be divided into 14 equal Parts, and the Content of the Circle inſcribed therein is equal to 11 of thoſe Parts; therefore the Content of the Square is multiplied by 11, and divided by 14 to give the Value of the 11 Parts contained in the Circle. The Reaſon of this Rule may be accounted for in this plain Manner. Suppoſe 45 *l.* was to be divided into 9 Parts, and 6 of thoſe Parts were requir'd? It's known by Head, $\frac{6}{9}$ of 45 is 30; however, multiply 45 by 6, and divide by 9, the Quotient is 30. See the following Example.

(N°. 110.)

45
6
9)270(30

To find the Content of a Circle by ſquaring the Diameter, and multiplying its Product by the given Decimal .7857. Let the Diameter be 14.

(N°. 111.)

14 } Diameters
14 }
56
14
196 Decimals
.7857
1372
980
1568
1372
153.9972 Content

The given Decimal is found thus,

14 = 100 = 11

11

—

100

100

—

14)1100(.7857 Decimal

98

(N°. 112.) 120

112

80 Add a Cypher

70

100 Add a Cypher

98

2

To find the Diameter of a Circle, whoſe Area ſhall contain a given Number, let 154 be the ſuppoſed Area, which multiply by 14 and divide by 11, the ſquare Root of the Quotient is the Diameter required.

154 Given Area

14

616

(N°. 113.) 154

11)2156(196 Quotient

11

105

99

66

66

—

0 Diviſor

Diviſor Dividend Quotient

1)196(14 Root or Diameter required
1

24)096
(N°. 114.) 96

0

N. B. This Rule, except extracting the Root, is no other than (N°. 106.) reverſed.

Of the Square ROOT.

The Square Root is ſomewhat more difficult to be underſtood than other common Rules; but is of ſo excellent Uſe in many Things, that a Perſon cannot make any material Progreſs in the Mathematicks (nor with Juſtice call himſelf a proper Meaſurer) without a perfect Knowledge thereof. It is work'd in ſome Meaſure like Diviſion, and conſiſts of Diviſor, Dividend and Quotient (the latter is the Root.) Obſerve this general Rule in all the whole Numbers of the Dividend, when they are even in Number of Places; begin with 2 Figures and ſo continue, but if they are odd as in (N°. 114.) begin with the firſt to the Left, and bring down the other by two Places of Figures to every Period. See (N°. 114.) Begin with 1 to the Left, ſay the Square of 1 is 1 Place, 1 in the Quotient and 1 in the Diviſor, and ſay once 1 is 1 from 1 and 0 remains, make a Dot over 1 to denote it has been work'd; then bring down 96 and double the firſt Diviſor 1, which bring down to a ſecond Diviſor, and mind to leave Room to the Right

Right of the new Diviſor for another Figure; then conſider how many 2's in 9, ſay 4, ſet 4 in the Quotient and 4 in the Diviſor, and multiply as in Diviſion; ſay 4 times 4 is 16 a 6 and carry 1, and 4 times 2 is 8 and 1 is 9; then ſubſtract 96 from 96 and 0 remains; the Root is 14 without any Remainder.

Suppoſe a cylindrical Veſſel was to be made 25 Inches deep, and to contain 84973 Cube Inches, it is required to know the Diameter? Firſt, divide the given Number of Inches by 25, and multiply the Quotient by 14, and divide by 11, the Square Root of the laſt Quotient is the Diameter required.

Diviſor	Dividend	Quotient	
	25)84973	(3398.92	To be carried to the next Example
	75		
	99		
	75		
	247		
(N°. 115.)	225		
	223		
	200		
	230		Add a Cypher
	225		
	50		Add a Cypher
	50		
	0		
			3398.92

3398.92
14 Given Number

13595 68
33989 2

Given Numbers 11)47584.88(4325.898 Carried to next Example
44

35
33

28
(N°. 116.) 22

64
55

98 Make a Dot in the Quotient
88

108
99

90 Add a Cypher
88

20 Add a Cypher
11

9

Bring

Bring down the Quotient, and extract its Square Root.

Dividend Quotient

Divisor 6)4325.8981(65.7715 Root
36

125) 725
625

1307)10089
(N°. 117.) 9149

13147)94081
92029

131541)205200 Add 2 Cyphers
131541

1315425)7365900 Add 2 Cyphers
6577125

788775 Remains

The required Diameter is 65 Inches, and $\frac{7715}{10000}$ of an Inch.

Now prove the Work by multiplying the Root in itself, and adding the Remainder: If the Work is right, the Product will be equal to the Quotient, and the 4 Cyphers which were added in carrying on the Work.

(N°. 118.)

65.7715
65.7715

(N°. 118.)

3 28 8575
6 57 715
4 60 40 05
46 04 00 5
328 85 75
3946 29 0

4325.89 02 1225	Product
.78 8775	Remainder
4325.89 81 0000	Proof

See (N°. 117.) Becauſe the Places of whole Numbers are equal, work 43, their greateſt ſquare Number is 6; ſet 6 in the Quotient and 6 in the Diviſor, and multiply as in Diviſon; ſay 6 times 6 is 36 from 43 and 7 remains; then bring down 25 to 7 and double 6 in the firſt Diviſor, and bring it down to the ſecond Diviſor, and obſerve as before cautionʼd in (N°. 114.) to leave Room for a Figure to be added on the Right, becauſe as yet, there is only 12 ſuppoſed to be in the ſecond Diviſor; then conſider how many 12's in 72, perhaps, it may be thought to go 6 times; but by multiplying it is found 5, place 5 in the Quotient and 5 in the Diviſor, ſay 5 times 5 is 25 a 5 and carry 2, and 5 times 2 is 10 and 2 is 12 a 2 and carry 1, and 5 times 1 is 5 and 1 is 6, from 725 and 100 remains; make a Dot in the Quotient, bring down the Decimals 89; then double the laſt

Figure of the ſecond Diviſor, and bring it down to a third, which makes 130, the 7 is ſuppoſed to be as yet unknown; conſider how many 13's in 100, or 130's in 1008, ſay 7, ſet 7 in the Diviſor and 7 in the Quotient, and multiply as in Diviſon, the Product is 9149 from 10089 and 940 remains, to which bring down 81, double the laſt Figure of the third Diviſor, and bring it down with the other Figures to a fourth Diviſor, which makes 1314, the 7 being ſuppoſed as yet unknown; then conſider how many times 13 in 94, or 131 in 940, ſay 7, multiply as before and the Product will be 92029, from 94081 and 2052 remains: Now the Dividend is all brought down, it may be carried as far as a Perſon pleaſes, by adding 2 Cyphers to every Remainder, and doubling the laſt Figure of each Diviſor.

To extract the ſquare Root of 6985449.

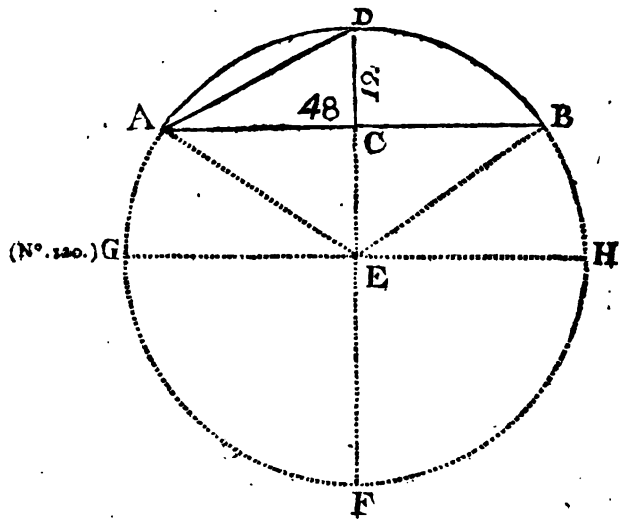
This being an odd Number of Figures, begin with the firſt to the Left.

```
                  . . . .
          2)6985499(2643.09
            4
          ------
         46)298.
            276
          ------
        524)2254
(N°.119.)   2096
          ------
       5283)15899
             15849
          ---------
     52869)500000   Add 2 Cyphers
           475821   Add 2 more
          ------
            24179   Remains
```

Say,

Say, the ſquare-Number in 6 is 2, place 2 in the Quotient and 2 in the Diviſor, and multiply as in Diviſion, ſay twice 2 is 4 from 6 and 2 remains, to which bring down 98; then double the firſt Diviſor and bring it down to a ſecond, and ſay, the 4's in 29 is 6, place 6 in the Quotient, and 6 in the Diviſor, and multiply as in Diviſion, the Product is 276 from 298 and 22 remains, to which bring down 54, double the laſt Figure of the ſecond Diviſor, and bring it down to a third, the fourth being ſuppoſed not yet known; ſay the 52 in 225 is 4, place 5 in the Quotient and 5 in the Diviſor, and multiply as before, the Product is 2096 from 2254 and 158 remains; to which bring down 99, double the laſt Figure of the third Diviſor, and bring them down to a fourth Diviſor, the 3 being ſuppoſed not yet to be known; ſay the 52's in 185 is 3, place 3 in the Quotient and 3 in the Diviſor, and multiply as before, the Product is 15849 from 15899 and 50 remains; add 2 Cyphers to the 50 and make a Dot in the Quotient; then double the laſt Figure of the fourth Diviſor, and bring it down to the fifth, the Diviſor 5286 is larger then the Dividend 5000; becauſe there has been 2 Cyphers added thereto, and it does not exceed the Diviſor, add a Cypher to the Quotient, and two more to the Dividend, and by working as before the Figure 9 will be found, which add to the Quotient and Diviſor and multiply and ſubſtract as before; and ſo you may continue by adding Cyphers, but the ſecond or third Places of Decimals is ſufficient for any practical Buſineſs.

To meaſure the Segment of a Circle, whoſe Baſe or Cord-Line is 48 Inches, and its perpendicular Height or Verſed Sine 12 Inches. See (N°. 120)



As the Meaſurement of a Circle is demonſtrated by its Area, containing an infinite Number of Angles tending to the Center, whoſe Cord or Baſe is the Circumference. See (N°. 102.) for the ſame Cauſe the Area of the Sector ADBE muſt be found; from which ſubſtract the Area of the Angle ABE, the Remainder is the Area of the Segment ADBA.

Obſerve: Square AC, half the given Cord, and divide its Content by the Verſed Sine CD, the Quotient is the Length of CF, to which add CD, their Sum is DF or GH. See the following Example.

24 } Half the Cord-Line e-
24 } qual to AC

96

(N°. 121.) 48

12)576(48 Equal to CF
48 | 12 Verſed Sine CD

96 | 60 Diameter FD or GH
96

0

The Diameter of the whole Circle being found, the next Line wanting is the Hypothenuſe AD, ſquare AC and CD, and add the Products together; then extract the ſquare Root of their Sum, the Quotient is the Hypothenuſe. See the following Examples.

24 } Half the Cord-Line e-
24 } qual to AC

(N°. 122.) 96

48

576 } 2 Products added
144 }

720 Carried to (N°. 124.)

12 } Verſed Sine CD
(N°. 123.) 12 }

24

12

144 Product

```
                2)720(26.832   Root or Cord AD
                   4
              46)320
                 276
             528)4400   Add 2 Cyphers
(N°. 124.)      4224
           5363)17600   Add 2 Cyphers
                16089
         53662)151100   Add 2 Cyphers
               107324
                43776   Remains
```

Next, multiply the Root last found by 8, then from the Product subtract AB, the Cord of the Segment, and divide the Remainder by 3, the Quotient is the Length of the Arch-Line ADB. See the following Examples.

```
                  26.832   Root or Cord AD
                       8   Given Number
(N°. 125.)       214.656   Product
                  48.000   AB
Given Number 3)166.656(55.552 Arch-Line ADB
               15....
                16
                15
                16
                15
                15
                 06
                 00
                  0
```

Now

Now multiply the Arch-Line ADB, by ¼ of the whole Diameter DF, the Product is the ſuperficial Content of the Sector. See the following Example.

	55.552	Arch-Line ADB
	15	One Fourth of FD
(N°. 126.)	277 760	
	555 52	
	833.280	Superficial Content of Sector ADBE

Now meaſure the Angle of ABE, and ſubſtract the Content from that of the Sector ADBE, the Remainder is the Meaſure of the Segment required; firſt conſider the whole Diameter FD is 60, its ½ DE is 30, from which ſubſtract CD 12, and 18 remains for CE. See the following Examples.

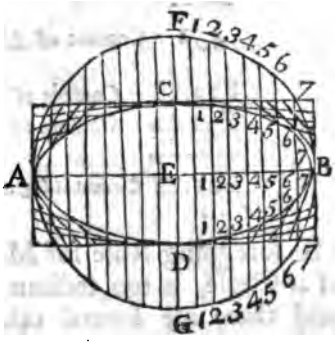
(N°. 127.)	48	Cord-Line AB
	9	Half the Verſed Sine CE
	432	Content of Angle ABE
	833.28	Content of Sector ADBE
(N°. 128.)	432.00	Content of Angle ABE
	401.28	Content of Segment ADB required

N. B. The foregoing Rule for Meaſuring the Segment of a Circle, is too tedious in common Practice, and there are ſeveral other Methods adapted for that Purpoſe; in curious Marble, *&c.* it's proper to meaſure to the greateſt Exactneſs, which

which may be done thus: See (N°. 120.) Deſcribe the Sector ADBE, and find its ſuperficial Content; then take the Length of the Arch by a Line, and proceed as in (N°s. 126, 127 and 128;) but in groſs Materials, multiply the Cord or Baſe by $\frac{1}{7}$ of the Verſed Sine or Perpendicular, its Difference from Truth being of no material Value.

To find the ſuperficial Content of an Ellipſis or Oval, ſee (N°. 129.) which is a Circle with 2 Ovals inſcribed therein of equal Diameters, but different Curves; the innermoſt may be call'd the mathematical Ellipſis, becauſe its two Diameters multiplied into each other, bears the ſame Proportion to its Area, as the Square of the Circle's Diameter does to its Area: The outward Curve is deſcribed by the Interſection of Lines, or by the Trammel, and ſometimes by a Line and Pins; but all theſe make the ſame Curve and is quicker in the Hanches than the former, which makes a Difference in the Meaſurement

(N°. 129.)



To

To know the ſuperficial Content of the inward Ellipſis, let the tranſverſe Diameter AB be 36, and the conjugate Diameter CD 18; multiply the one into the other, and their Product by 11, and divide by 14, gives the Content required. See the following Example and (N°. 106.)

	36	Tranſverſe Diameter AB
	18	Conjugate Diameter CD
	288	
	36	
	648	Product
	11	
	648	
(N°. 130.)	648	
14)7128(509.14		Content required
	70	
	128	
	126	
	20	Add a Cypher
	14	
	60	Add a Cypher
	56	
	4	

Or thus by a given Decimal. See the following Example and (N°. 111.)

	36	Tranſverſe Diameter AB
	18	Conjugate Diameter CD
	288	
	36	
	648	
(N°. 131.)	,7857	Decimal
	4536	
	3240	
	5184	
	4536	
	509.1336	Content required

Demonſtration. See the inward Ellipſis in (N°. 129.) Becauſe the Circle AFBG is divided into equally diſtant parallel Lines, and the conjugate Diameter of the Oval, is equal to half the Diameter FG of the Circle, and GD, DE, EC and CF are equal, ſo is 1 to 1, 2 to 2, 3 to 3, and ſo on; therefore, the inward Oval muſt be equal to half the Circle, and bear the ſame Proportion to AB, and CD multiplied into each other, as the Circle does to the Square of its Diameter.

N. B. See the outſide Curve (N°. 129.) I have meaſured ſeveral Sizes of theſe practical Ovals, and find their ſuperficial Content to be near $\frac{1}{20}$ Part more than a mathematical Oval of the ſame Diameters; therefore I think it the beſt Rule to meaſure them as ſuch, and add $\frac{1}{20}$ Part of the Product to itſelf; otherwiſe it will be ſo much leſs than its real Meaſure. To

To find the ſuperficial Content of the Face of a Globe: Multiply the Circumference by the Diameter, the Product is the Meaſure required.

To know the ſuperficial Content of a Globe, whoſe Diameter is 20. See the following Example.

Firſt, Find the Circumference.

7 = 22 = 20

20

7)440(62.857 Circumference

(N°. 132.)

42

20
14

60 Add a Cypher
56

40 Add a Cypher
35

50 Add a Cypher
49

1

62.857 Circumference
(N°. 133.) 20 Diameter

1257.140 Superficial Content required

To know the ſuperficial Content of a Globe, whoſe Diameter is 24 Inches. See the following Example.

7 = 22 = 24

24

88

44

7)528(75.428 Circumference

(N°. 134.) 49

38

35

30 Add a Cypher

28

20 Add a Cypher

14

60 Add a Cypher

56

4

75.428 Circumference

24 Diameter

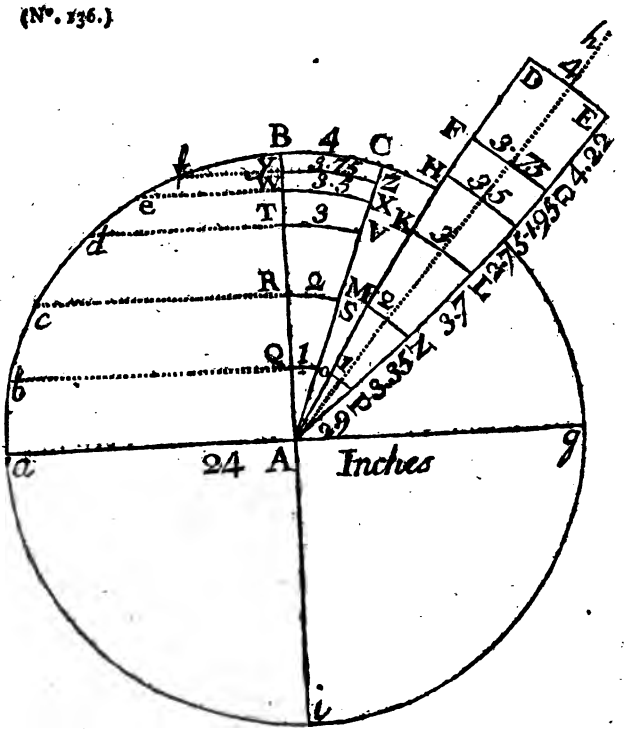
(N°. 135.) 301 712

1508 56

1810.272 Superficial Content required

Demonſtra-

(N°. 136.)



Demonſtration. See (N°. 136.) This Figure proves the Face of a Globe to be equal to 4 times the Area of a Circle of the ſame Diameter, *ag* is 24 Inches, and the Semi-Diameter AB is divided into 4 equal Parts at QRT, and TB is ſubdivided by w, and wB by y; the dotted Lines are perpendicular from AB to the Quadrant aB, which gives the ſeveral Diviſions for the Angle ADE. See the Angle ABC with its Diviſions, ſuppoſed to be drawn on the Circle or Baſe of one of the Semi-Diameters

ters of the Globe; then ſee the Angle ADE, ſuppoſed to be that Part of the Face of the Globe, which is perpendicular over the Angle ABC, whoſe middle dotted Line A4, is equal to the Curve of the Quadrant aB; becauſe AO of the Angle ADE is equal to *ab* on the Curve aB, and OM equal to *bc*, and MK to *cd*, and KH to *de*, and HF to *ef*, and FD to fB; again, becauſe OP is equal to Qo and MN to RS, and KL to TV, and HI to WX, and FG to yz, and DE to BC; which proves the Angle ADE muſt be to the Angle ABC, as the ſuperficial Face of half the Globe is to its circular Baſe, and by meaſuring every Diviſion on the Line AE, ſeparate by their ſeveral Widths, which when added together produce 48, and is double the Angle ABC, becauſe AB is 12, and BC is 4, the latter cannot produce more than 24, which proves half the ſuperficial Face of the Globe to be equal to twice its Baſe, conſequently the other Half muſt be equal to the ſame; but obſerve, the more Diviſions the Angles are divided into, the nearer it is to Truth; becauſe, the Face of a Globe is made up of an infinite Number of Circles, whoſe Axis is their Center, therefore cannot be demonſtrated to Perfection, no more than the Circle can be ſquared by its infinite Number of Angles; yet they anſwer as near Truth as Men can deviſe.

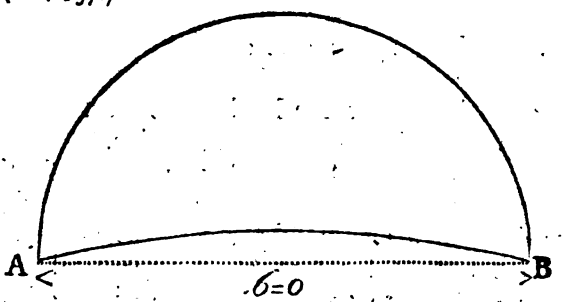
N.B. (N°. 136.) gives the Lines for the covering a Globe, or Nich with any of the uſual Materials; and the Angles may be of any Size, ſo they are divided in the ſame Proportion to each other; but obſerve to make true Joints by tacking in a Nail or Pin in every Point of the Diviſions,

viſions, as in AoMKHFD, and bend a thin Rule to touch them all at once, which will give the true curve Joint; ſo of AE, &c.

To know the ſuperficial Meaſure of the Crown of a Nich, take its whole Diameter acroſs the Front, and find a Circle proportionable thereto; its Area is equal to the ſuperficial Meaſure required.

Let the Diameter AB of the Nich, be 6 Feet. See (N°. 137.)

(N°. 137.)



Find the Circumference.

7=22=6

6

7)132(18.857 Circumference

7

62

(N°. 138.) 56

60 Add a Cypher

56

40 Add a Cypher

35

50 Add a Cypher

49

1

18.857

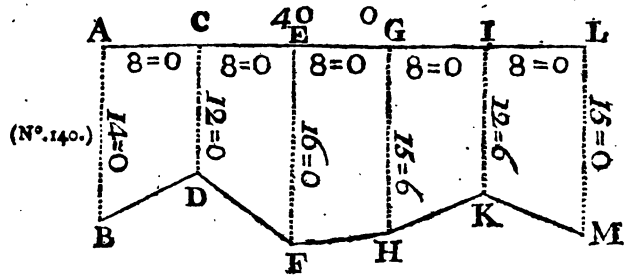
	18.857	Circumference
	1.5	One 4th of Diameter
	94285	
(N°.139.)	188 57	
Feet	28.2855	
	12	Inches in a Foot
	5710	
	2855	
Long Inches	3.4260	

The Meaſure of the Nich is 28 Feet 3 Long Inches, and $\frac{426}{1000}$ of an Inch remains.

Demonſtration. See (N°. 137.) Becauſe the ſuperficial Face of a Globe is 4 times more than the Area of a Circle of the ſame Diameter, a Nich being $\frac{1}{4}$ of a Globe; its ſuperficial Face muſt be equal to the Area of one Circle of the ſame Diameter.

To find the ſuperficial Content of a Wall 40 Feet long, in which are 6 different Heights at equal Diſtance to each other; to the ſingle Height of the two outſide Lines AB, and LM add double that of the inſide Lines CD, EF, GH, IK, and multiply half their Sum by one Space, the Product is the Content required. See (N°. 140.) and the following Example.

(N°. 140.)



		Feet	
Single	AB	14 - 0	
	LM	15 - 0	
(N°.141.)	CD	24 - 0	
Double	EF	32 - 0	
	GH	31 - 0	
	IK	25 - 0	
		141 - 0	Sum
		70 - 6	Half Sum
		8 - 0	
Feet		564 - 0	Content of ~~Whole~~ Wall

Demonſtration. The two outſide Lines AB, and LM are ſet down ſingle, becauſe they each repreſent but one Side of a Space; but thoſe in the Middle each repreſents two; they are halved, becauſe all ſuperficial Planes which have two parallel Sides of unequal Lengths, are added together, and their Half is the true Mean to multiply by the Width, whoſe Product is the true ſuperficial Content.

Suppoſe the Wall (Nº. 140.) was taken at 6 Heights (as is common) and they added together, and divided by 6 for a mean Proportion to be multiplied by the Length for the Content of the Wall. See how this differs from the other Meaſure.

(Nº. 142.)

	Feet	Inches
AB	14	0
CD	12	0
EF	16	0
GH	15	6
IK	12	6
LM	15	0

6)85 - 0(14.16 Mean Height
6
25
24
10
6
40
36
4

(Nº. 143.)

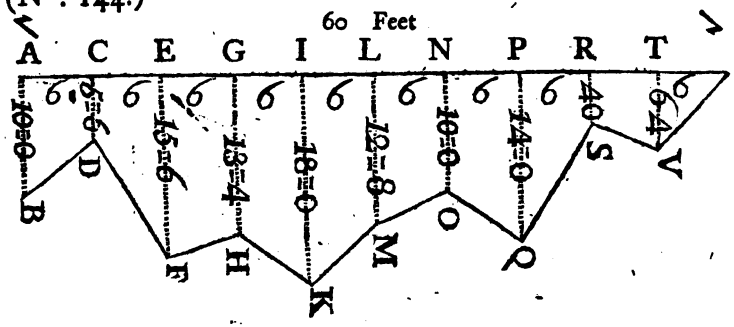
14.16		Mean Height
40		Length
566.40		Content

This laſt Example differs 2 Feet, and almoſt 6 Inches from Truth, and the more unequal the Heights are the more it makes the Content.

To

To know the Content of a Plane Superficies, or Wall, whoſe Heights are unequal in Length, but equally diſtant from each other. See (N°. 144.) and the following Example.

(N°. 144.)



Work this as (N°s. 140, and 141.) only with this Difference, ſet down twice the Line TV, becauſe there is an Angle without; otherwiſe the Meaſure of that Angle will be loſt.

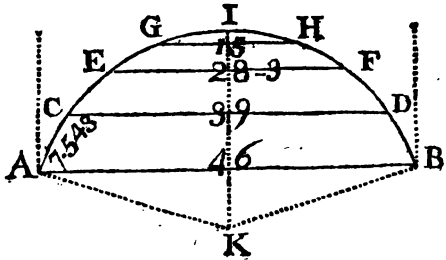
(N°. 145.)

Single	AB	10	0
Double	CD	11	0
	EF	31	0
	GH	26	8
	IK	36	0
	LM	25	4
	NO	20	0
	PQ	28	0
	RS	8	0
	TV	12	8
		208 - 8	Sum
		104 - 4	Half Sum
		6 - 0	Width of AC, &c.
		626 - 0	Content required

N.B. (N°s. 140 and 144) are not only ſet down as Examples to take the different Heights of Walls, &c. but as an Introduction of this Method in the meaſuring the ſuperficial Faces of ſeveral Kinds of Convex and Concave Dimenſions; as in the following Example.

To find the ſuperficial Content of the Face of a Globe's *Fruſtum* or Concave. See (N°. 146.)

(N°. 146.)



Divide the Arch AI and BI into any Number of equal Parts, the more the truer the Work (for Reaſons laid down in the Demonſtrations of (N°. 136.) from whence draw ſtrait Lines, as AB, CD, EF and GH, and meaſure their ſeveral Diameters as in this Example, which may be done in a Concave or Inſide of a Dome; but if the Dimenſion be a Convex, or Outſide of a large Globe or Dome, &c. it may be proper to erect Perpendiculars, as from A and B, from whence meaſure to the Diviſions as C and D, and ſubſtract them from the great Diameter A B, the Remainder is the Line CD; and ſo of the other Diviſions, when the Lengths of all the Diameters are known: Conſider the Rules laid down in (N°s. 144 and 145.) then ſet down the

ſingle

ſingle Length of the Diameter AB, and twice the Lengths of CD, EF and GH, and halve their Sum; then ſuppoſe the half Sum of the Diameters to be the Diameter of one Circle, and find a Circumference proportionable thereto, which multiply by one Diviſion on the Arch-line as AC, &c. their Product is the ſuperficial Content of the Fruſtum of a Globe or Concave, as required.

See (N°. 146.) and the following Example.

		Feet Inches	
Single	AB	46 - 0	
Double	CD	78 - 0	
	EF	56 - 6	
	GH	30 - 0	
		210 - 6	Sum
7 = 22 =		105.25	Half Sum
		22	
		21050	
		21050	
		7)2315.50(330.78	Circumference
(N°. 147.)		21	
		21	
		055	
		49	
		60	
		56	
		4	

330.78

330.78 Circumf. brought down
7.543 Diviſion AC (N°.146.)

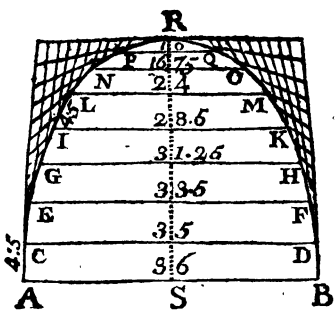
(N°. 148.)

99234
1323112
165390
231546

2495.07 3 54 Superficial Content required

To find the ſuperficial Content of an Ovalar Convex, or Concave Dome. See (N°. 149.)

(N°. 149.)



Divide the Curves AR and BR into any Number of equal Parts, the more the better, and find the Diameters as in the foregoing Example; then ſet down the Length of the Line AB ſingle, and all the other double, and halve their Sum, and find a Circumference proportionable thereto, which multiply by one of the Diviſions on the Curve as AC, their Product is the ſuperficial Content required.

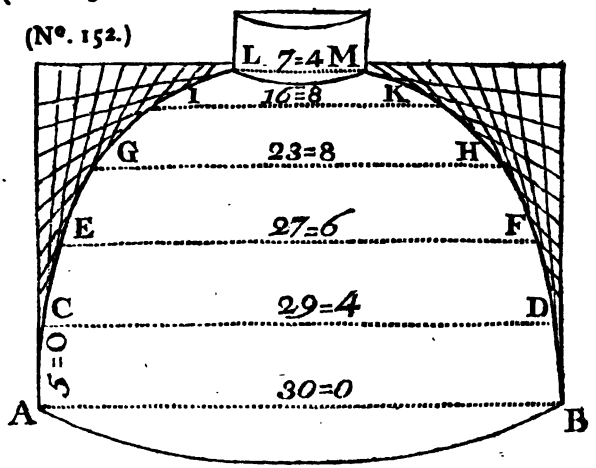
Single

Single	AB	36	
(N°. 150.) Double	CD	70	
	EF	67	
	GH	62.5	
	IK	57	
	LM	48	
	NO	33.5	
	PQ	20	
		394	Sum
7=22=		197	Half Sum
		22	
		394	
		394	
	7)4334(	619	Circumference
		42	
		13	
		7	
		64	
		63	
		1	Remains
		619	Circumference
		4.5	Diviſion AC (N°. 149.)
(N°. 151.)		3095	
		2476	
		2785.5	Content required

To

To find the ſuperficial Content of the Convex or Concave Face of a Dome, there being a Cupola or Well-hole on the Crown, not intended to be meaſured in this Dimenſion. See (N°. 152.)

(N°. 152.)



Divide the Curves AL and BM into any Number of equal Parts, as AC, CE, EG, GI and IL; alſo, as BD, DF, FH, HK and KM, and meaſure their ſeveral Diameters as repreſented by the dotted Lines; then ſee (N°s. 140, and 141) where the two outſide Lines are ſet down ſingle, for which Reaſon ſet down the Diameters AB and LM ſingle, and all the other double, and halve their Sum, which ſuppoſe to be the Diameter of a Circle; then find a Circumference proportionable thereto, which multiply by one of the Diviſions on the Curves as AC, their Product is the ſuperficial Content required.

Single

		Feet	Inches
Single	LM	7	- 4
Double (N°. 153.)	IK	33	- 4
	GH	47	- 4
	EF	55	- 0
	CD	58	- 8
Single	AB	30	- 0
		231	- 8 Sum
		115	- 10 Half Sum

7 = 22 = 115.833 Decimal of 10 Inches

22

231 666

2316 66

7)2548.326(364.046 Circumference

21 · · · · · 5 AC (N°.152.)

(N°. 154.)

44 | Feet 1820.230 Content

42 | 12

28 260

28 230

032 | Inches 2.560

28 |

46

42

4

N. B. The foregoing Rules beginning at (N°. 140.) commands all flat Superficies either ſtrait-lined or curv'd, where there are no large Angles or Curves between the Extents of the equal diſtant parallel Lines (as between B D or D F, *&c.* in N°. 140.) becauſe it brings the whole Dimenſion into one Parallelogram, whoſe Length is proportionable to all the equal diſtant Lines, and its Width to one of the Diviſions; again, ſee (N°. 146.) which is ſuppoſed to be the Fruſtum of a Globe or Concave, the Arch A I B is its middle Section, which is the Segment of a Circle, whoſe Meaſure may be ſhew'd by the ſame Rule. Thus, multiply the half Sum 105.25 by the Width 7.543 A C, their Product is the ſuperficial Content of the Segment A I B (and ſo of the two following Sections N°s. 149 and 152 and all other Curves.) But to return to the ſuperficial Meaſure of the Globe or Concave: The half Sum 105.25 is ſuppoſed to be the Diameter of a Circle, whoſe Circumference is found proportionable thereto, which is 330.78, and is the Length of a Parallelogram when multiplied by the Width 7.543 A C, the Product is the ſuperficial Content of the Fruſtum required; it may not be well underſtood by ſome, why the half Sum being made the Diameter of a Circle ſhould give a Circumference proportionable to the Length of a Parallelogram, which ſhall give the true Content required: For Example, ſee (N°. 146.) and find the different Lengths for the 3 Parallelograms and Crown, which make 4 Diameters of Circles, and find their ſeveral Circumferences, which muſt be equal to that of the half Sum. See the following Examples.

AB 46
CD 39

85

First Diameter 42.5

7=22=42.5
2 2

850
850

(N°. 155.) 7)935.0(133.571 1st Circumference
7

23
21

25
24

40
35

50
49

10

3

CD 39
EF 28

67

33.5 Half Sum

7=22=33.5
2 2

670
670

7)737.0(105.285 ad Circumference
7...

(N°. 156.)

037
35

20
14

60
56

40
35

5

EF

EF 28
GH 15

43

21.5 Half Sum

7 = 22 = 21.5
22

(N°. 157.) 430
430

7)473.0(67.571 3d Circumference
42

53
49

40
35

50
49

10
7

3

GH

GH 15

7.5 Half Sum

7 = 22 = 7.5

2 2

150 | 133.571 }
150 | 105.285 } 4 Circumf.
2 | 67.571 }
7)165.0(23.571 }

(N°. 158.) 14

329.998 See (N°. 147.)

25
21

40
35

50
49

10
7

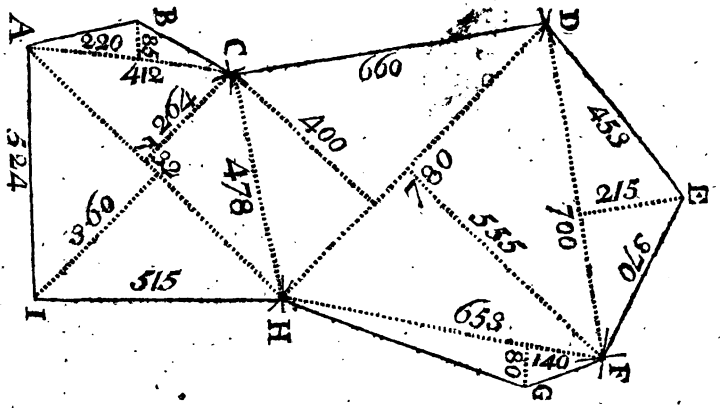
3

N. B. There is a ſmall Difference between the Circumference (N°. 147.) and this in (N°. 158.) which is occaſioned by the Remainder of Decimals in theſe laſt Examples.

To take the Plan of a Piece of Ground, by the Chain only, and caſt up the Meaſurement by Links. See (N°. 159.)

(N°. 159.)

(N°. 159.)



Obſerve to begin with the firſt Angle at I, and meaſure to A which is 524 Links; take that Number from the Scale, and draw the Line IA; then obſerve which is the next Point to make the Angle, (ſee H,) meaſure AH, and take its Length from the Scale in your Compaſſes; with one Foot in A ſtrike an Arch at Pleaſure towards the Point H; then meaſure HI, and take the Length in your Compaſſes; with one Foot in I, ſtrike an Arch to interſect the Arch at H, from whence draw the Lines HA and HI, and note down their Lengths on the Plan, as in this Example. Stand at A and let your Aſſiſtant hold a Staff upright oppoſite B, and direct him to move it in a Line with AC, and there ſtick it down and meaſure AC, which note down on a By-Paper; alſo, note down the Diſtance from A to the Staff and the Depth of the off-ſet Meaſure CH, and note down its Length on your By-Paper; then

then having the two Lengths noted down, take 478 in your Compaſſes, with one Foot H, ſtrike an Arch as at C; then take 412 in your Compaſſes from A, interſect the Arch at C, from whence drawn the Lines CH and CA, and note down their Lengths on the Plan, as in the Example; then take 220 Links from the Scale and ſet it from A on the Line towards C, from whence raiſe a Perpendicular to denote the Off-ſet, and ſet on 85 Links, from whence draw the Lines BA and BC; again, meaſure CD, and note down its Length on the By-Paper; alſo DH, and do the ſame; then take 660 in your Compaſſes from C, ſtrike an Arch at D, and take 780 in your Compaſſes from H, interſect the Arch at D, from whence draw the Lines DC and DH, and note down their Lengths on the Plan as in the Example; then meaſure DF and FH, and note down their Lengths in the By-Paper; alſo take 700 and from D ſtrike an Arch at F; then take 653 and from H interſect the Arch at F, from whence draw the Lines FD and FH, and note down their Lengths on the Plan; then ſtand at F and let your Aſſiſtant hold a Staff upright oppoſite G, and direct him to ſet it in a Line with FH, and thete ſtick it down; then meaſure from F to the Staff, which proves 140, and from the Staff meaſure the Depth of the Off-ſet which is 80, note them both down in your By-Paper; then take 140, and ſet it from F on the Line towards H, from whence raiſe a Perpendicular to G, ſet on 80 from the Staff towards G, and draw the Lines FG and GH; again, meaſure DE and EF, and

note

note down their Lengths as before; then take 370, and from F ſtrike an Arch at E and take 453, and from D interſect the Arch at E; draw the Lines ED and EF, and note down their Lengths on the Plan: Now the Angles are taken, let fall a Perpendicular to the Baſe from every Point, and meaſure their Lengths by the Scale on the Plan, and note them down as in the Example.

Caſt up the ſeveral Angles thus: Multiply their Baſe by ½ their Perpendicular, as demonſtrated by (N°. 99.) and obſerve where two Angles have one Baſe, multiply that Baſe by half the Length of the two Perpendiculars, their Product gives the Content of both Angles in one Sum. See the following Examples.

	AH	739	Baſe
	IC	312	Half Perpendiculars
		1478	
		739	
		2217	
		230568	Content of ACHI
	AC	412	Baſe
	B	42.5	Half Perpendiculars
(N°. 160.)		2060	
		824	
		1648	
		17510.0	Content of ABC

HD	780	Base
CF	477.5	Half Perpendiculars
	3900	
	5460	
	5460	
	3120	
	372450.0	Content of CDFH
HF	653	Base
G	40	Half Perpendiculars
(N°. 160.)	26120	Content of HGF
DF	700	Base
E	107.5	Half Perpendicular
	3500	
	4900	
	7000	
	75250.0	
	230568	Square Links
	17510	
	372450	
	26120	
(N°. 161.)	75250	
Acres	7)21898	
	4	Roods in an Acre
No Roods	87592	
	40	Perch in a Rood
Perch	35)03680	

The

The Content of (N°. 159.) is 7 Acres, no Roods, 35 Perch, and $\frac{8160}{100000}$ remains.

Obſerve, When the Dimenſions are ſquared they produce ſquare Links, which are added all together in one Sum to throw them into Acres, 5 Figures to the Right muſt be cut off, and all that remains to the Left are ſo many Acres; becauſe an Acre contains 100,000 ſquare Links, therefore the 1 muſt be equal to an Acre; again, the Remainder is multiplied by 4, becauſe an Acre contains 4 Roods, therefore 5 Figures to the Right are cut off, and thoſe to the Left are Roods; again, the ſecond Remainder is multiplied by 40, becauſe a Rood contains 40 Perch, cut off 5 Figures to the Right, and all thoſe to the Left are Perch, the Remainder is ſo many of 100,000 of a Perch, not worth farther Notice.

To throw any given Number in Length of Chains and Links, into Feet by a given Decimal, provided the Links be according to the Statute of *England*, which are 25 to 16 Feet 6 Inches. The Chain is generally made 4 Perch long equal to 66 Feet, and is divided into 100 Links, each Link is 7.92 Inches.

To know how many Feet in Length, is contain'd in 67451 Links of *Gunter*'s Chain.

	674 51	Links
(N°. 162.)	.66	Decimal
	4047 06	
	40470 6	
Feet	44517.66	
	12	Inches in a Foot
	132	
	66	
Inches	7.92	
	4	Quarters in an Inch
Quarters	3.68	

The Sum is 44517 Feet 7 Inches and $\frac{1}{4}$, and $\frac{68}{100}$ of a Quarter of an Inch remains.

To know how many Feet in Length is contain'd in 999 Links of *Gunter*'s Chain.

	999	Links
(N°. 163.)	.66	Decimal
	59 94	
	599 4	
Feet,	659.34	
	12	Inches in a Foot
	68	
	34	
Inches	4.08	
	4	Quarters in an Inch
	32	

The

The Sum is 659 Feet 4 Inches, and $\frac{92}{100}$ of a Quarter of an Inch.

To prove the Decimal .66. See how many Feet is contained in 100 Links of *Gunter*'s Chain.

	100	Links
	.66	Decimal
(N°. 164.)	600	
	600	
Feet	66.00	Proof becauſe 100 Links is equal to 66 Feet

To prove a Link of *Gunter*'s Chain to be 7.92 Inches, multiply the one Link by 25 Links, and divide by 12 Inches, the Quotient will be 16 Feet 6 Inches.

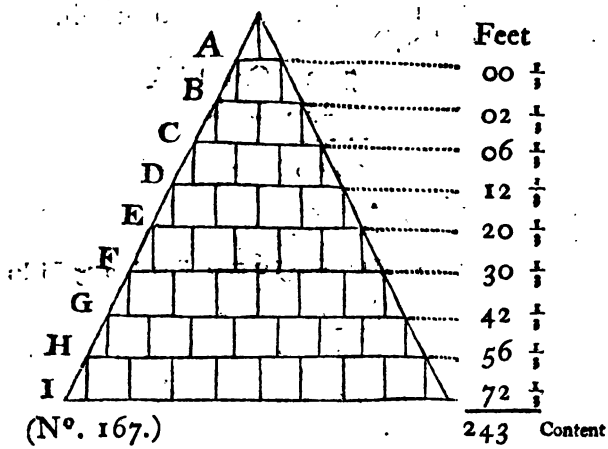
	7.92	One Link
	25	Links
	3960	
(N°. 165.)	1584	
	12)198.00(16=6	Equal to 25 Links
	12	
	78	
	72	
	6	Inches

To find the ſolid Content of a Pyramid 9 Feet ſquare at Baſe, and the ſame Altitude. Multiply

Multiply the Area of the Base by $\frac{1}{3}$ of the Altitude, their Product is the Content required. See the following Example.

	9 } 9 }	Feet
(N°. 166.)	81	Product of Base
	3	One Third of Altitude
	243	Solid Content

Demonstration. See (N°. 167.) which proves a Pyramid to be equal to $\frac{1}{3}$ of a Parallelopipedon or Cube, whose Ends and Length is equal to the Base and Altitude of the Pyramid.



(N°. 167.)

This Figure is made up of 9 Courses of 1 Foot high each: The upper Course A contains 4 quarter Pyramids or 6 Inches Base equal to $\frac{1}{3}$ of a Foot Cube: The Course B contains 1 Cube Foot,

Foot, and 4 Wedges of 6 Inches Baſe equal to 1 Cube Foot, and 4 quarter Pyramids at the Angles of 6 Inches Baſe equal to $\frac{1}{3}$ of a Cube Foot, the Whole 2 Feet $\frac{1}{3}$: The Courſe C contains 4 Cube Feet and 8 Wedges equal to 2 Feet, and 4 quarter Pyramids equal to $\frac{1}{3}$ of a Foot, the Whole 6 Feet $\frac{1}{3}$: The Courſe D contains 9 Cube Feet and 12 Wedges equal to 3 Feet, and 4 quarter Pyramids equal to $\frac{1}{3}$ of a Foot, the Whole 12 Feet $\frac{1}{3}$: The Courſe E contains 16 Cube Feet and 16 Wedges equal to 4 Cube Feet, and 4 quarter Pyramids equal to $\frac{1}{3}$ of a Foot, the Whole 20 Feet $\frac{1}{3}$: The Courſe F contains 25 Cube Feet and 20 Wedges equal to 5 Feet, and 4 quarter Pyramids equal to $\frac{1}{3}$ of a Foot, the Whole 30 Feet $\frac{1}{3}$: The Courſe G contains 36 Cube Feet and 24 Wedges equal to 6 Feet, and 4 quarter Pyramids in the Angles equal to $\frac{1}{3}$ of a Foot, the Whole 42 Feet $\frac{1}{3}$: The Courſe H contains 49 Cube Feet and 28 Wedges equal to 7 Feet, and 4 quarter Pyramids equal to $\frac{1}{3}$ of a Foot, the Whole 56 Feet $\frac{1}{3}$: The Courſe I contains 64 Cube Feet and 32 Wedges equal to 8 Feet, and 4 quarter Pyramids in the Angles equal to $\frac{1}{3}$ of a Foot, the Whole 72 Feet $\frac{1}{3}$. See the Table in (N°. 167.) which ſhews the whole Content of the Pyramid equal to (N°. 166.)

To prove by Figures a Pyramid to be $\frac{1}{3}$ of a Cube, whoſe Sides are equal to the Baſe and Altitude of the ſame. See (N°s. 166 and 167.) and the following Example.

	9 }	Feet
	9 }	
	81	Equal to Baſe
	9	
(N°. 168.)	729	Product of Cube

3)729(243 Proof
6

12
12

09
9

0

To know the ſolid Content of the Fruſtum of a Pyramid, 9 Feet ſquare at the greater Baſe, and 3 Feet ſquare at the leſſer Baſe, and its Altitude 6 Feet.

Obſerve, To the greater Side AB, add half the leſſer Side CD, multiply their Sum by the greater Side AB; again, to the leſſer Side CD, add half the greater Side AB, multiply their Sum by the leſſer Side CD; then add the Products together, and multiply their Sum by ⅓ of the Altitude gives the Content required. See the following Example.

	3	CD
	4.5	Half AB
	7.5	Sum
	3	CD
	22.5	Product
	.9	AB
	1.5	Half CD
	10.5	Sum
(N°. 169.)	9	AB
	94.5	Product
	22.5	Product
	117.0	Sum
	2	One 3d of Altitude
	234	Content required

Or thus: Multiply the Side of the greater End AB, by the Side of the leſſer End CD, and add the Product to the Areas of both Ends. See the following Example.

	9	AB
	3	CD
	27	Product
	81	Area of AB
	9	Area of CD
	27	Product of AB, CD
(N°. 170.)	117	Sum
	2	One 3d of Altitude
	234	Content required

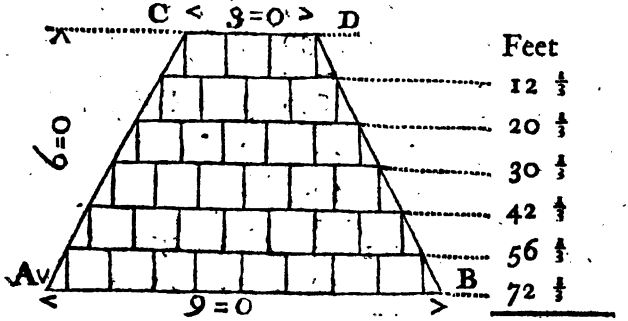
Or thus: Multiply the Areas of both Ends into each other, and extract the ſquare Root of their Product; then to the two Areas add the Root, and multiply their Sum by ⅓ of the Altitude, the Product is the Content required. See the following Example.

```
      81   Area of AB
       9   Area of CD
     ----
2)729(27   Root
   4
  ----
47)329
   329
  ----
     0

      81   Area of AB
       9   Area of CD
      27   Root
     ----
     117   Sum
       2   One-Third of Altitude
     ----
     234   Content required
```

For Demonſtration of the Truth of the three foregoing Rules, ſee (N°. 172.) which is equal with the ſix lower Courſes of (N°. 167.)

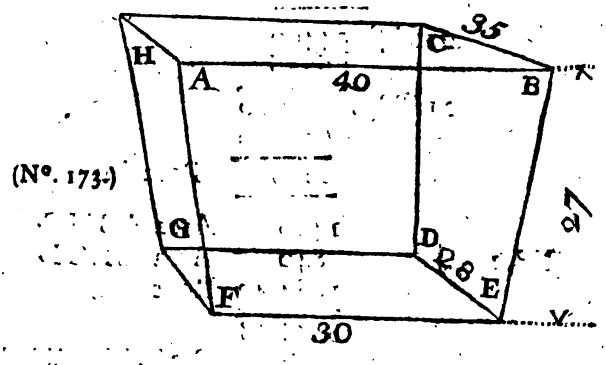
(N°. 172.)



(N°. 172.)

See (N°. 173.) Whoſe Top and Bottom are out of Proportion to each other.

To find its ſolid Content, multiply the Areas of the Top and Bottom into each other, and extract the ſquare Root of their Product; then to their two Areas add the Root, and multiply their Sum by ⅓ of the Altitude, the Product is the Content required. See (N^os. 173 and 174.)



(N°. 173.)

28 DE
30 EF

840 Area EFGD

35 CB
40 AB

1400 Area ABHC
840 Area EFGD

56000
11200

1)1176000(1084.43 Root
1

208)01760
1664

2164) 9600
8656

21684) 94400
86736

216883) 766400
650649

115751 Remains

1400 Area ABHC
(N°. 174.) 840 Area EEGD
1084.43 Root

3324.43
9 One Third of Altitude

29919.87 Content required

Of

Or thus: To the Greater AB 40, add half the Leſſer EF 15; multiply by the Greater CB 35; again, to the Leſſer EF 30, add half the Greater AB 20, multiply by the Leſſer DE 28, add the two Products together, and multiply their Sum by $\frac{1}{3}$ of the Altitude, the Product is the Content required.

See the following Example.

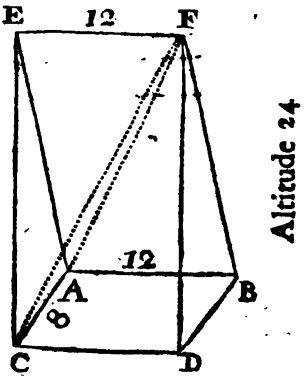
	30	EF
	20	Half AB
	50	Sum
	28	DE
	400	
	100	
	1400	Product
	40	AB
	15	Half EF
	55	Sum
	35	CB
(Nº. 175.)	275	
	165	
	1925	Product
	1400	Product
	3325	
	9	One Third of Altitude
	29925	Content required

N.B.

N. B. There is a ſmall Difference of 5.13, in the two Contents, a Trifle in ſo large a Number; the Reaſon is, becauſe the Bottom and Top of the Object (N°. 173.) are not proportionable to each other; but where they are ſo, and are Squares or Oblongs, I would recommend the foregoing Rule (N°. 175.) otherwiſe, if they differ in Proportion, or are angular or curved, the Rule laid down in (N°. 174) is more preferable.

To find the ſolid Content of a Wedge, whoſe Side ACE, is parallel with the Side BDF, multiply the Area of the Heel by half the Altitude, gives the ſolid Content.

(N°. 176.)



(N°. 177.)

12	
8	
96	Area of Heel
12	Half Altitude
192	
96	
1152	Content required

See

See (N°. 176.) and obſerve the Croſs-lines A F and C F, which ſuppoſe to be ſaw'd through, the one is a Pyramid, and the other in the Form of a Reel, with 2 ſharp Edges at Right Angles. I have known ſuch like Bodies, whoſe Meaſurement has been required in order to eſtimate their Weight, when they have been intended to be caſt in Metal.

To know the ſolid Content of the Reel Piece A C E F. (See (N°. 176.) multiply the one End by the other, and their Product by ⅓ of the Altitudes or Length, the Product is the ſolid Content required.

	12	E F
	8	A C
(N°. 178.)	96	Sum
	·4	One Sixth of Length
	384	Content required

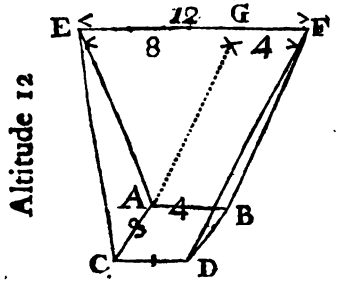
Demonſtration. See (N°. 176.) which is a parallel Wedge, and conſequently equal to half a Parallelopipedon or Cube, whoſe Ends and Length is equal to its Baſe and Altitude; again conſider the Pyramid A B C D F is equal to ⅓ of the Parallelopipedon or Cube, (which is proved by N°. 167.) of which the whole Wedge is equal to half, and the Pyramid muſt be equal to ⅔ of the Wedge, and the Reel Piece A C E F, which remains equal to ⅓ of the ſame; and conſequently equal to half the Pyramid, and ⅙ of the Parallelopipedon or Cube, whoſe Ends and Length are equal to the Baſe and Altitude of the Wedge; therefore all Pieces which are cut

to

to ſharp Edges, at right Angles to each other, as ACEF, muſt be meaſured as (N°. 178.)

To know the ſolid Content of a Wedge, whoſe Sides are not parallel, ſee (N°. 179.) Firſt, ſquare the Heel ABCD, and multiply it by half the Altitude or Length EC, the Product is the ſolid Content of ABCDGF; then multiply AC by EG, and their Product by ⅓ of the Altitude, the Product is the ſolid Content of ACEG; add the two Products together, and their Sum is the ſolid Content of ABCD EF required. See the following Example.

(N°. 179.)



4	AB
3	AC
12	Sum
6	Half Altitude
72	Content of ABCDFG

(N°. 180.)

8	EG
3	AC
24	Sum
2	One Sixth of Altitude
48	Content of ACEG
72	Content of ABCDFG
120	Content required

Or

Or thus: Meaſure ABCDF as a Pyramid, and EFAC as a Reel Piece, it produces the ſame.

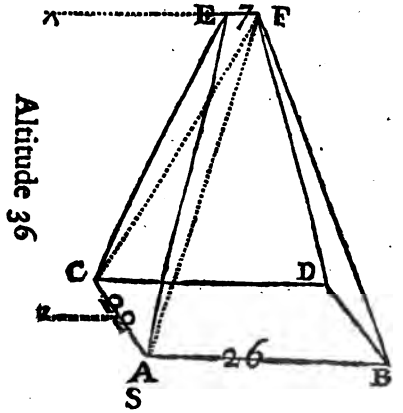
4	AB
3	AC
12	Sum
4	One Third of Altitude
48	Content of ABCDF

(N°. 181.)

12	EF
3	AC
36	
2	One Sixth of Altitude
72	Content of ACEF
48	Content of ABCDF
120	Content required

To know the ſolid Content of a double taper'd Wedge. See (N°. 182.) Firſt, meaſure ABCDF as a Pyramid; then ACEF as a Reel Piece, and add their Products together, their Sum will be the Content required.

(N°. 182.)



	22	AC
	7	EF
(N°. 183.)	154	
	6	One 6th of Altitude
	924	Content of ACEF
	26	AB
	22	AC
	52	
	52	
	572	Content of Base
	12	One Third of Altitude
	1144	
	572	
	6864	Content of Pyramid
	924	Content of Reel Piece
	7788	Content of ABCDEF required

To find the solid Content of a Globe or Sphere, multiply the Diameter by the Circumference, and their Product by $\frac{1}{6}$ of the Diameter, gives the Content required. See (N°. 185.) which represents the Section of a Globe 42 Inches Diameter.

First find the Circumference.

(N°. 184.)

7 = 22 = 42 Diameter

22

84

84

7)924(132 Circumference

(N°. 184.) 7··

22

21

14

14

0

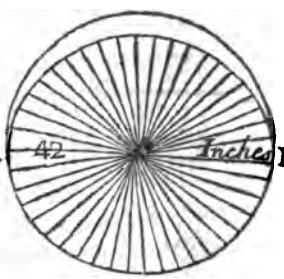
132 Circumference
42 Diameter

264

528

5544 Superficial Content
7 One 6th of Diameter

38808 Solid Content

(N°. 185.) A  B

Demonſtration. The Circumference multiplied by the Diameter, is proved to produce the ſuperficial Face of a Globe, by (N°s. 135 and 136.) again, becauſe the Body of a Globe contains an infinite Number of Pyramids pointing

to the Center, whoſe Baſe is the ſuperficial Face of a Globe, and their Altitude is the Semi-Diameter, $\frac{1}{2}$ of which is the proportionable Number to be multiplied, with the Area of their Baſe, to give their ſolid Content, as proved by (N°s. 166 and 167.) Therefore $\frac{1}{2}$ of the Diameter multiplied by the ſuperficial Face of the Globe, muſt be the ſolid Content.

To find the ſolid Content of a Globe by a given Decimal, multiply the Cube, whoſe Sides are equal to the Diameter of the Globe by .5238094, their Product is the Content required. See (N°. 185.) and the following Example.

	42 42	Diameters
	84 168	
	1764	
(N°. 186.)	42	Diameter
	3528 7056	
	74088	Solid Content of Cube
	.5238094	Given Decimal
	296352 666792 00000 59 2704 222 264 1481 76 37044 0	
	38807.9908272	Content required

N. B.

N. B. I calculated this Decimal from the following Reaſons, becauſe the ſolid Content of a Globe, is $\frac{2}{3}$ of that of a Cylinder of the ſame Diameter and Height: Let it be 42 Inches as in the foregoing Examples. Obſerve, it is proved, that the ſuperficial Face of a Globe is the Baſe of an infinite Number of Pyramids contain'd therein, and that its Area is 4 times more than the Area of a Circle of the ſame Diameter; for which Reaſon I throw the Face of the Globe into one Circle, and imagine to have an infinite Number of Pyramids placed thereon, whoſe Altitude is 21 Inches equal to the Semi-Diameter of the Globe; then multiply the Area of that Circle by 7 Inches, it being $\frac{1}{3}$ of the Altitude of thoſe imaginary Pyramids, the Product muſt be a Cylinder of 7 Inches high, whoſe ſolid Content is equal with the Globe; but its Area at the End, is 4 times more than a Circle whoſe Diameter is 42 Inches; therefore, I divide the Area of the Cylinder's End into 4 Circles, whoſe Diameters are each 42 Inches equal with that of the Globe, and ſet them one over the other, which makes a Cylinder of 28 Inches high; then conſider what Part of 42 is 28, ſay $\frac{2}{3}$, which proves a Globe to be $\frac{2}{3}$ of a Cylinder of the ſame Diameter and Height, becauſe this of 28 Inches high is equal with the Globe in Solidity and Diameter, and no more than $\frac{2}{3}$ of its Height.

The next Thing to be conſidered is to know, what Proportion a Cylinder of the ſame Height and Diameter bears to a Cube, whoſe Sides are equal to that and the Diameter of a Globe. See

(No. 106

(N°s. 106 and 107.) which is a Circle inſcribed in a Square, whoſe Area is there proved to be $\frac{11}{14}$ of the Square, which Proportion the Body of the Cylinder bears to the Cube; becauſe they bear the ſame Proportion from one End to the other, for which Reaſon the Decimal of the Cylinder muſt be found. Say, as 14 is to 100, ſo is 11 to the Decimal of the Cylinder. See the following Example.

14 = 100 = 11

11

100

100

14)1100(.7857142 A given Decimal to find the Content of a Cylinder

98

120

(N°. 187.) 112

80 Add a Cypher

70

100 Add a Cypher

98

20 Add a Cypher

14

60 Add a Cypher

56

40 Add a Cypher

28

12 Next

Next find the Decimal of the Globe, becauſe the ſolid Content of a Globe is $\frac{2}{3}$ of that of a Cylinder of the ſame Diameter and Height; ſay, as 3 is to the Decimal of the Cylinder, ſo is 2 to the Decimal of the Globe. See the following Example.

3 = 7857142 = 2

2

3)15714284(.5238094 — A given Decimal for the Meaſurement of a Globe See (N°. 186.)

15·····

07

6

11

(N°. 188.) 9

24

24

028

27

14

12

2

Let

Let a Cube of 12 Inches ſquare be given to know the ſolid Content of a Cylinder of the ſame Height and Diameter. Firſt, find the Inches in a Cube Foot, which multiply by the given Decimal. (See N°. 187.) .7857142, and the following Example.

```
                    12
                    12
                   ---
                    24
                   12
                  ----
                   144
                    12
                  ----
                   288
(N°. 189.)         144
                  ----
                  1728   Inches in a Cube Foot
               .7857142  Given Decimal
               -------
                  3456
                 6912
                1728
               12096
               8640
             13824
          12096
          ----------
          1357.7141376   Content required
```

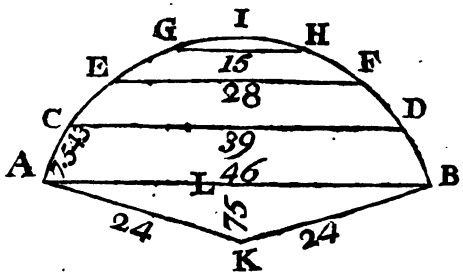
To know the Content of a Globe, whoſe Diameter is 12 Inches, by a given Decimal. See (N°. 188.) for the Decimal.

(N°. 190.)

```
                12
                12
                --
                24
                12
                --
               144
                12
                --
               288
               144
               ---
              1728   Inches in a Cube Foot
          ·5238094
          --------
              6912
             15552
             0000
            13824
             5184
              3456
               864 0
          --------
905.1426432  Content
```

To find the ſolid Content of the Fruſtum of a Globe. See AIB in (N°. 191.) and obſerve that ABK is no Part of the Fruſtum; but is drawn in the Example to repreſent the Center, and compleat the Pyramids.

(N°. 191.)



First, Find the superficial Content of the Face, which is already done in (N°. 148.) then consider a Globe contains an infinite Number of Pyramids pointing to the Center, of which the superficial Face is the Base, and AK, IK and BK is the Altitude. Look in (N°. 148.) which gives the superficial Face of the Frustum (N°. 146.) equal to (N°. 191.) whose Content is 2495.07354, which multiply by $\frac{1}{3}$ of the Altitude AK, IK or BK, the Product is the Solid Content of AIBK, from which subtract the Cone ABK; the Remainder is the solid Content of the Frustum AIB. See the following Examples

(N°. 192.)

2495.07354	Superficial Face
8	One 3d of Altitude AK, &c.
19960.58832	Solid Content of AIBK
4156.3875	Solid Content of ABK
15804.20082	Solid Content required

Now

Now find the ſold Content of the Cone ABK.

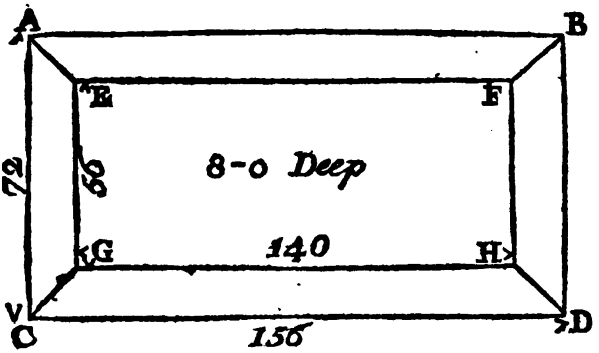
7 = 22 = 46
22
92
92
7)1012(144.57 Circumf. of AB
7
31
28
32
28
40 Add a Cypher
35
50 Add a Cypher
49
1
144.57 Circumference
11.5 One 4th of Diameter
72285
14457
14457
1662.555 Contents of Baſe or Circle AB
2.5 One 3d of Altitude KL
8312775
3325110
4156.3875 Solid Contents of Cone ABK

(N°. 193.)

(N°. 194.)

To find the Content in Cube Yards of a Baſon for Water, whoſe Form is the Fruſtum of an oblong Pyramid. See the Rule laid down in (N.°. 169 and 175.) and the following Example.

(Nº. 195.)



140	GH
78	Half CD
218	Sum
56	GE
1308	
1090	
12208	Product

156

156 CD
70 Half GH

226 Sum
72 AC

452
1582

(N°. 196.) 16272 Product
12208 Product

28480
2.66 One 3d of Depth or Altitude

170880
170880
56960

Feet in a Cube Yd. 27)75756.80(2805.8 Content required
54

217
216

156
135

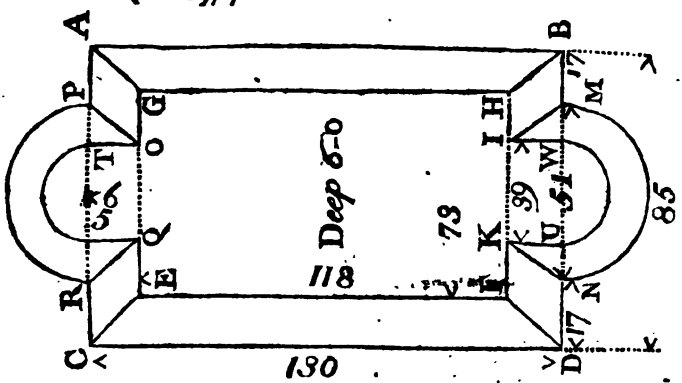
218
216

2

To

To know the Content in Cube Yards of a Baſon for Water, whoſe Form contains the Fruſtum of an Oblong Pyramid; alſo, the Fruſtum of a Cone and two Right-angled Triangles. See (N°. 197.) and the following Examples.

(N°. 197.)



See the three foregoing Examples, and by the ſame Rule begin to meaſure the Fruſtum of the Oblong Pyramid ABCDEFGH.

118	EF
65	Half CD
183	Sum
73	HF
549	
1281	
13359	Product

130 CD
59 Half EF

189 Sum
85 DB

945

(N°. 198.) 1512

16065 Product

13359

29424 Sum
2 One 3d of Depth or Altitude

58848 Solid Cont. of Fruſtum ABCDEFGH

The two Semi-Circles at each End makes the Fruſtum of a Cone, whoſe larger Diameter M N is 51, and leſſer Diameter U W, &c. is 39; find their Circumferences and Areas, and proceed as is laid down in (N°. 171 or 174.)

7=22=39 IK

22

78

78

7)858(122.57 Circumference

7··

15

14

18

14

40 Add a Cypher

35

50 Add a Cypher

49

1

7 = 22 = 51 MN

22

102

(N°. 199.) 102

7)1122(160.28 Circumference

7··

42

42

020 Add a Cypher

14

60 Add a Cypher

56

4

160.28 Circumference MN

12.75 One 4th of Diameter MN

80140

112196

32056

16028

2043.5700 Area of Circle MN

122.57

122.57 Circumference IK
9.75 One 4th of Diameter IK

612 85
(N°.200.) 85799
110313
1195.0575 Area of Circle IK
2043.57 Area MN.

83654025
59752875
35851725
47802300
239011500

1)2442183.655275(1562.748 Root
1 1195.0575 Area IK
25)144 2043.57 Area MN
125

4801.3755
2 One 3d of Depth or Altitude

396)1921
1836

9602.7510 Solid Content of Fruſtum MNRP

3122)8583
6244

31247)233965
218729

312544)1523652
1250176

3125488)27347675
25003904

2343771

There ſtill remains unmeaſured, two ſolid Right Angles, as KNU MIW RQS and POT equal to 6 Baſe and 6 Altitude, both which added together makes a ſquare ſolid Body or Parallelopipedon, whoſe Sides are 6 and its Length is 39 for the Diameter KI, &c. and $\frac{2}{3}$ of the Slope WM, which is equal to 4, becauſe each end is a Pyramid of 6 Altitude; ſo the Length in ſolid Meaſure is 43, which multiply by the Area of the two Sides, the Product is its Content.

	6	Side
	6	Side
(N°. 201.)	36	
	43	
	108	
	144	
		Content of the two Right Angle
	1548	Solids between the two Fruſtums
	58848	Content of Fruſtum ABCDEFGH
	9602.751	Content of Fruſtum MNRP
	69998.751	The ſolid Content required

The

The Uſe of an Inſtrument called a TANGENT RULE, *for the taking any given Diſtance within a Quarter of a Mile.*

SUPPOSE the Object to be croſs a River or the like. FIG. 1. Repreſents the Face of the Inſtrument, and FIG. 2. is the perſpective Elevation, BD is 6 Feet 8 Inches Long divided into 16000 equal Parts, by the Help of a $\frac{1}{16}$ Inch diagonal Scale, of which FIG. 3. repreſents 6000 drawn to its full Proportion. The Diſtance between the Center C and the lower Line of the Scale at D, is five Links of *Gunter*'s Chain equal to 39 Inches, and $\frac{6}{10}$, the Blade of the Square F muſt extend preciſely to that Line (as in the Example) in order to bring down the Diviſions to its Interſection, by the Index BL, as at M.

N.B. There is no Need to divide by the Scale any more than 6000 from D, (as FIG. 3.) becauſe all the other Parts anſwer to Objects within Reach of a 10 Foot Pole; but the large Diviſions of Thouſands muſt be carefully divided on the whole Length between B and D; and obſerve, the 60 ſmall Diviſions on FIG. 1. as from D, are ſo many Hundreds, the Scale of this Draught being too ſmall to ſet on the Sub-diviſions; but they are repreſented by FIG. 3.

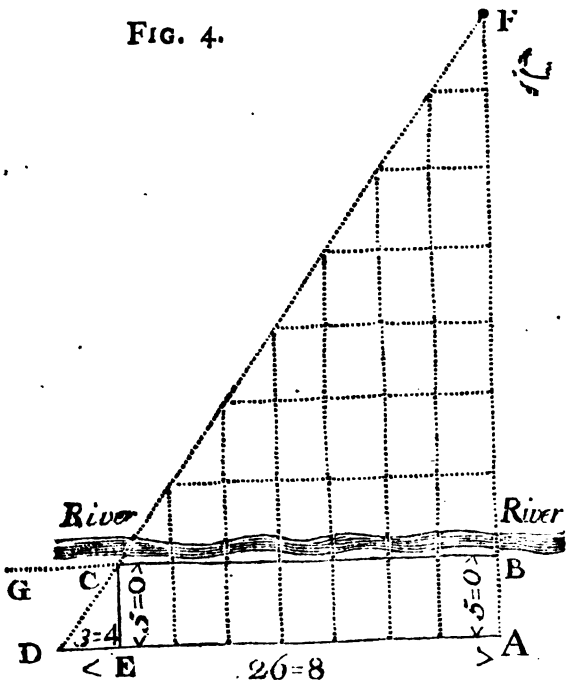
The Tangent Rule may be made of light Wood, and fixed to the Index of the Theodolite, ſo that it may be taken off or ſet on as Occaſion requires, and faſtened by Screws at A and B, at the Diſcretion of the Inſtrument-Maker. The only Perſon of that Trade, to which

I have demonſtrated this Inſtrument, is Mr. *John Bennett*, at the *Globe* in *Crown-Court* near *Golden-Square*, St. *James's*.

Of the TABLES.

They are calculated from this ſimple mathematical Principle. See FIG. 4.

FIG. 4.



The Diſtance from A to F is required, without croſſing the River; ſet a Staff up at A and another as at B in a Line with AF, from whence raiſe a Perpendicular to D, draw BG of a Length

Length at Pleaſure parallel to AD; then ſet up a Staff at D and another as at C on the Line GB in a direct Line with DF, draw a Line from C to the Line AD parallel with AB as CE, the Length AB or EC are 5 Feet, meaſure DE which proves to be 3 Feet 4 Inches; then does every 3 Feet 4 Inches on the Line AD produce 5 Feet to the Object F on the Line AF, and where there is a Remainder, it bears the ſame Proportion as EC is to DC, the Line AD is 26 Feet 8 Inches, which contains 8 Times the Space ED, and proves the Diſtance AF to be 8 Times 5 Feet equal to 40.

As AD, FIG. 4. is divided into 8 Parts, BD FIG. 1. which repreſents the ſame Line, is divided into 16000 Parts; again, as AB FIG. 4. is 5 Feet, CD FIG. 1. which repreſents the ſame Line is 5 Links, ſo I calculated my Numbers by Diviſion and Multiplication, beginning at Number 40, and ſo on to Number 5328, becauſe thoſe under 40, not only run too far for the Object to be preciſely diſtinguiſh'd; but cauſe the Angle to be ſo acute, that it cannot ſo well be depended on, and thoſe above 5328 bring the Angle near enough to be meaſured by a 10 Foot Rod. And obſerve, at Number 700 I drop every other Number to 1000, and from thence to 2000; I have calculated but every 4th Number, and from 2000 to 4000 only every 8th Number, and from 4000 to the End of the Table, every 16th Number, becauſe the Difference is ſmall decimal Parts, and would ſwell the Tables to an unneceſſary Size.

To

To find a Diſtance, move the Inſtrument about till the Index GH or AB cuts the Object, continue it in the ſame Poſition, and move the Index IK or CEL till it alſo cuts the Object; then ſee what Diviſion the Index cuts as at M, which ſuppoſe to be 3056. Look in the Table for that Number, and you will find againſt it 26 Links, and $\frac{17}{100}$ of a Link, which is the Diſtance; again, ſuppoſe the Index to cut 90 on the Inſtrument, look for Number 90 in the Table, and you will find againſt it 888 Links; again, if it cuts 40 you will find againſt it 2000 Links, which is equal to a Quarter of a Mile, and ſo of all other Numbers.

N. B. If the Index cuts on any of the Numbers which are left out, look in the Tables for the Number neareſt to it, and take the Diſtance from the Length againſt that Number, the Difference from Truth will be only the ſmall decimal Part of a Link.

Diſtance in LINKS.

N°.	Links	N°.	Links	N°.	Links
40	2000	49	1632	58	1379
41	1951	50	1600	59	1355
42	1904	51	1568	60	1333
43	1860	52	1538	61	1309
44	1818	53	1509	62	1290
45	1777	54	1481	63	1269
46	1739	55	1454	64	1277
47	1702	56	1428	65	1230
48	1666	57	1403	66	1212

N°.	Links	N°.	Links	N°.	Links
67	1194	100	800	133	601.5
68	1176	101	792	134	597
69	1159	102	784.3	135	592.5
70	1142	103	776.7	136	588.2
71	1126	104	769.2	137	583.5
72	1111	105	761.9	138	579.6
73	1095	106	754.7	139	575.5
74	1081	107	747.6	140	571.4
75	1066	108	740.7	141	567.3
76	1052	109	733.9	142	563.3
77	1039	110	727.25	143	559
78	1025	111	720.7	144	555.5
79	1012	112	714.25	145	551.7
80	1000	113	707.9	146	547.9
81	987	114	701.75	147	543.8
82	975	115	695.5	148	540.5
83	963	116	689.6	149	536.5
84	952	117	683.75	150	533.3
85	941	118	677.9	151	529.8
86	930	119	672.25	152	526.3
87	919	120	666	153	522.8
88	909	121	661.1	154	519.4
89	898	122	654.9	155	516.1
90	888	123	650	156	512.8
91	879	124	645	157	509.5
92	869	125	640	158	506.3
93	860	126	635	159	503.1
94	851	127	629.9	160	500
95	842	128	625	161	496.9
96	833	129	620	162	493.8
97	824	130	615	163	490.8
98	816	131	610.7	164	487.8
99	808	132	606	165	484.8

N°.	Links	N°.	Links	N°.	Links
166	481.9	199	402	232	344.8
167	478.9	200	400	233	343.3
168	476.2	201	398	234	341.9
169	473	202	396	235	340
170	470.5	203	394	236	338.9
171	467.8	204	392.1	237	337.5
172	465	205	390	238	336.1
173	462.4	206	388.3	239	334.7
174	459.75	207	386.4	240	333.3
175	457.1	208	384.6	241	331.9
176	454.5	209	382.5	242	330.5
177	451.9	210	380.9	243	329.2
178	449.4	211	379.1	244	327.5
179	446.6	212	377.3	245	326.3
180	444.4	213	375.5	246	325
181	441.9	214	373.8	247	323.8
182	439.5	215	372	248	322.5
183	436.8	216	370.3	249	321.25
184	434.75	217	368.6	250	320
185	432.4	218	366.9	251	318.75
186	430	219	365.3	252	317.5
187	427.75	220	363.6	253	316.2
188	425.5	221	361.75	254	314.9
189	423.25	222	360.3	255	313.7
190	421	223	358.75	256	312.5
191	418.8	224	357.1	257	311
192	416.4	225	355.5	258	310.2
193	414.5	226	353.9	259	308.8
194	412.3	227	352.4	260	307.5
195	410	228	350.9	261	306.5
196	408.1	229	349.3	262	305.3
197	406	230	347.7	263	304.1
198	404	231	346.3	264	303

N°.	Links	N°.	Links	N°.	Links
265	301.9	298	268.25	331	241.7
266	300.7	299	267.55	332	240.95
267	299.6	300	266.4	333	240
268	298.5	301	265.6	334	239.45
269	297.2	302	264.9	335	238.8
270	296	303	264	336	238.1
271	295	304	263.15	337	237.35
272	294.1	305	262.3	338	236.5
273	293	306	261.4	339	236
274	291.8	307	260.6	340	235.25
275	290.2	308	259.7	341	234.6
276	289.8	309	258 9	342	233.9
277	288.8	310	258	343	233.2
278	287.75	311	257.25	344	232.5
279	286.75	312	256 4	345	231.9
280	285.7	313	255.6	346	231.2
281	284.7	314	254.75	347	230.5
282	283.65	315	254	348	229.8
283	282.7	316	253.1	349	229.2
284	281.65	317	252.3	350	228.5
285	280.5	318	251.6	351	227.9
286	279.5	319	250.75	352	227 25
287	278.75	320	250	353	226.6
288	277.75	321	249.4	354	225.95
289	276.8	322	248.45	355	225.35
290	275.85	323	247.65	356	224.7
291	274.75	324	246.9	357	224.1
292	273.95	325	246.1	358	223.3
293	273	326	245.4	359	223.8
294	271.9	327	244.6	360	222.2
295	271.2	328	243.9	361	221.6
296	270.25	329	243.1	362	220.95
297	269.35	330	242.4	363	220.35

N°.	Links	N°.	Links	N°.	Links
364	219.75	397	201.5	430	186
365	219.15	398	201	431	185 6
366	218.4	399	200.5	432	185.15
367	217.95	400	200	433	184.75
368	217.37	401	199.5	434	184.3
369	216.8	402	199	435	183.9
370	216.2	403	198.5	436	183.45
371	215.6	404	198	437	183
372	215	405	197.5	438	182.65
373	214.45	406	197	439	182.2
374	213.62	407	196.56	440	181.8
375	213.3	408	196	441	181.4
376	212.75	409	196.5	442	180.87
377	212.2	410	195	443	180.5
378	211.6	411	194.6	444	180.15
379	211.1	412	194.15	445	179.75
380	210.5	413	193.7	446	179.37
381	210	414	193.2	447	178.85
382	209.4	415	192.75	448	178.55
383	208.9	416	192.3	449	178.15
384	208.2	417	191.85	450	177.75
385	207.8	418	191.25	451	177.4
386	207.25	419	190.9	452	176.95
387	206.7	420	190.45	453	176.6
388	206.15	421	190	454	176.2
389	205.65	422	189.55	455	175.8
390	205	423	189.1	456	175.45
391	204.6	424	188.65	457	175
392	204	425	188.25	458	174.55
393	203.55	426	187.75	459	174.3
394	203	427	187.25	460	173.85
395	202.5	428	186.9	461	173.55
396	202	429	186.3	462	173.15

N°.	Links	N°.	Links	N°.	Links
463	172.8	496	161.25	529	151,25
464	172.4	497	161	530	150.95
465	172	498	160.64	531	150.65
466	171.65	499	160.3	532	150.35
467	171.3	500	160	533	150.1
468	170.95	501	159.6	534	149.8
469	170.55	502	159.37	535	149.5
470	170.2	503	159	536	149.25
471	169.85	504	158.75	537	148.95
472	169.45	505	158.4	538	148.6
473	169.1	506	158.1	539	148.3
474	168.75	507	157.8	540	148
475	168.4	508	157.45	541	147.75
476	168.06	509	157.15	542	147.5
477	167.6	510	156.85	543	147.25
478	167.35	511	156.5	544	147
479	167	512	156.25	545	146.75
480	166.66	513	155.9	546	146.5
481	166.3	514	155.5	547	146.25
482	165.95	515	155.3	548	145.8
483	165.6	516	155	549	145.6
484	165.25	517	154.75	550	145.4
485	164.95	518	154.4	551	145.15
486	164.6	519	154.1	552	144.8
487	164.27	520	153.75	553	144.65
488	163.75	521	153.5	554	144.4
489	163.6	522	153.25	555	144.15
490	163.15	523	152.95	556	143.87
491	162.9	524	152.65	557	143.6
492	162.5	525	152.4	558	143.37
493	162.25	526	152	559	143.1
494	161.9	527	151.8	560	142.85
495	161.5	528	151.5	561	142.6

N°.	Links	N°.	Links	N°.	Links
562	142.35	595	134.35	628	127.4
563	142.1	596	134.12	629	127.2
564	141.82	597	134	630	127
565	141.6	598	133.77	631	126.8
566	141.35	599	133.55	632	126.55
567	141.1	600	133.3	633	126.35
568	140.82	601	133.1	634	126.15
569	140.6	602	132.8	635	125.95
570	140.35	603	132.65	636	125.8
571	140.1	604	132.45	637	125.55
572	139.75	605	132.2	638	125.37
573	139.6	606	132	639	125.2
574	139.37	607	131.8	640	125
575	139.1	608	131.57	641	124.8
576	138.87	609	131.3	642	124.6
577	138.65	610	131.15	643	124.4
578	138.4	611	130.9	644	124.22
579	138.15	612	130.7	645	124
580	137.92	613	130.5	646	123.82
581	137.7	614	130.3	647	123.65
582	137.37	615	130.05	648	123.45
583	137.2	616	129.85	649	123.25
584	136.97	617	129.65	650	123.07
585	136.75	618	129.45	651	122.9
586	136.5	619	129.25	652	122.7
587	136.3	620	129	653	122.5
588	135.95	621	128.8	654	122.3
589	135.8	622	128.62	655	122.13
590	135.6	623	128.4	656	121.95
591	135.35	624	128.2	657	121.75
592	135.12	625	128	658	121.55
593	134.9	626	127.8	659	121.4
594	134.67	627	127.6	660	121.2

N°.	Links	N°.	Links	N°.	Links
661	121	694	115.25	754	106.1
662	120.85	695	115.1	756	105.92
663	120.69	696	114.94	758	105.55
664	120.47	697	114.77	760	105.25
665	120.3	698	114.6	762	105
666	120.1	699	114.44	764	104.71
667	119.9	700	114.25	766	104.45
668	119.72	702	113.95	768	104.16
669	119.55	704	113.62	770	103.9
670	119.4	706	113.3	772	103.64
671	119.25	708	112.97	774	103.35
672	119.05	710	112.67	776	103.07
673	118.85	712	112.35	778	102.82
674	118.67	714	112.05	780	102.5
675	118.51	716	111.73	782	102.3
676	118.25	718	111.42	784	102
677	118.16	720	111.11	786	101.77
678	118	722	110.8	788	101.5
679	117.82	724	110.49	790	101.25
680	117.64	726	110.17	792	101
681	117.47	728	109.94	794	100.75
682	117.3	730	109.58	796	100.5
683	117.13	732	109.2	798	100.25
684	116.95	734	108.97	800	100
685	116.78	736	108.67	802	99.75
686	116.6	738	108.4	804	99.5
687	116.44	740	108.1	806	99.25
688	116.25	742	107.8	808	99
689	116.11	744	107.5	810	98.75
690	115.95	746	107.22	812	98.5
691	115.77	748	106.82	814	98.28
692	115.6	750	106.65	816	98
693	115.44	752	106.37	818	97.79

820

N°.	Links	N°.	Links	N°.	Links
820	97.5	886	90.25	952	84.03
822	97.3	888	90.07	954	83.8
824	97.07	890	89.87	956	83.67
826	96.85	892	89.68	958	83.5
828	96.6	894	89.42	960	83.33
830	96.37	896	89.27	962	83.15
832	96.15	898	89.07	964	82.97
834	95.92	900	88.87	966	82.8
836	95.62	902	88.7	968	82.62
838	95.45	904	88.47	970	82.42
840	95.22	906	88.3	972	82.3
842	95	908	88.1	974	82.13
844	94.77	910	87.9	976	81.87
846	94.55	912	87.72	978	81.79
848	94.32	914	87.5	980	81.57
850	94.12	916	87.27	982	81.45
852	93.87	918	87.15	984	81.25
854	93.62	920	86.92	986	81.12
856	93.45	922	86.77	988	80.95
858	93.24	924	86.57	990	80.75
860	93	926	86.4	992	80.62
862	92.8	928	86.2	994	80.5
864	92.57	930	86	996	80.32
866	92.37	932	85.82	998	80.15
868	92.15	934	85.63	1000	80
870	91.95	936	85.47	1004	79.68
872	91.72	938	85.27	1008	79.37
874	91.5	940	85.1	1012	79.05
876	91.32	942	84.92	1016	78.72
878	91.1	944	84.72	1020	78.42
880	90.9	946	84.55	1024	78.12
882	90.7	948	84.37	1028	77.75
884	90.43	950	84.2	1032	77.5

N°.	Links	N°.	Links	N°.	Links
1036	77.2	1168	68.48	1300	61.53
1040	76.87	1172	68.25	1304	61.35
1044	76.62	1176	67.97	1308	61.15
1048	76.32	1180	67.8	1312	60.97
1052	76	1184	67.56	1316	60.77
1056	75.75	1188	67.33	1320	60.6
1060	75.47	1192	67.06	1324	60.42
1064	75.17	1196	66.88	1328	60.23
1068	74.9	1200	66.65	1332	60.05
1072	74.62	1204	66.4	1336	59.86
1076	74.3	1208	66.22	1340	59.7
1080	74	1212	66	1344	59.52
1084	73.75	1216	65.78	1348	59.33
1088	73.5	1220	65.57	1352	59.12
1092	73.25	1224	65.35	1356	59
1096	72.9	1228	65.15	1360	58.82
1100	72.7	1232	64.92	1364	58.65
1104	72.4	1236	64.72	1368	58.47
1108	72.2	1240	64.5	1372	58.3
1112	71.93	1244	64.31	1376	58.12
1116	71.68	1248	64.1	1380	57.97
1120	71.42	1252	63.9	1384	57.8
1124	71.17	1256	63.7	1388	57.62
1128	70.91	1260	63.5	1392	57.47
1132	70.67	1264	63.27	1396	57.3
1136	70.41	1268	63.07	1400	57.12
1140	70.12	1272	62.9	1404	56.97
1144	69.87	1276	62.68	1408	56.81
1148	69.67	1280	62.5	1412	56.65
1152	69.43	1284	62.3	1416	56.48
1156	69.2	1288	62.11	1420	56.33
1160	68.96	1292	61.91	1424	56.17
1164	68.68	1296	61.72	1428	56.02

N°.	Links	N°.	Links	N°.	Links
1432	55.86	1564	51.15	1696	47.16
1436	55.71	1568	51	1700	47.06
1440	55.55	1572	50.88	1704	46.93
1444	55.4	1576	50.75	1708	46.81
1448	55.24	1580	50.62	1712	46.72
1452	55.8	1584	50 5	1716	46.62
1456	54.97	1588	50.37	1720	46.5
1460	54.79	1592	50.25	1724	46 4
1464	54.6	1596	50.12	1728	46.28
1468	54.48	1600	50	1732	46.18
1472	54.33	1604	49.87	1736	46.07
1476	54.2	1608	49.75	1740	45.97
1480	54.05	1612	49.62	1744	45.86
1484	53.9	1616	49 5	1748	45.75
1488	53.75	1620	49.37	1752	45.66
1492	53.61	1624	49.25	1756	45.55
1496	53.41	1628	49.14	1760	45.45
1500	53.32	1632	49	1764	45.35
1504	53.18	1636	48.89	1768	45.21
1508	53.05	1640	48.75	1772	45.12
1512	52.96	1644	48.65	1776	45.03
1516	52.77	1648	48.53	1780	44.93
1520	52.62	1652	48.42	1784	44.84
1524	52.5	1656	48.3	1788	44.71
1528	52.35	1660	48.18	1792	44.63
1532	52.22	1664	48.07	1796	44.53
1536	52.08	1668	47.96	1800	44.43
1540	51.95	1672	47.81	1804	44.35
1544	51.82	1676	47 72	1808	44.23
1548	51.67	1680	47.61	1812	44.15
1552	51.53	1684	47 5	1816	44.05
1556	51.41	1688	47 38	1820	43.95
1560	51.25	1692	47.27	1824	43.86

N°.	Links	N°.	Links	N°.	Links
1828	43.75	1960	40.78	2184	36.62
1832	43.63	1964	40.72	2192	36.45
1836	43.57	1968	40.62	2200	36.35
1840	43.46	1972	40.56	2208	36.2
1844	43.38	1976	40.47	2216	36.1
1848	43.28	1980	40.38	2224	35.96
1852	43.2	1984	40.31	2232	35.84
1856	43.1	1988	40.25	2240	35.71
1860	43	1992	40.16	2248	35.58
1864	42.91	1996	40.07	2256	35.45
1868	42.81	2000	40	2264	35.33
1872	42.73	2008	39.84	2272	35.2
1876	42.63	2016	39.68	2280	35 06
1880	42.55	2024	39.52	2288	34.93
1884	42.46	2032	39.36	2296	34.83
1888	42.36	2040	39.21	2304	34.71
1892	42.27	2048	39.06	2312	34.6
1896	42.18	2056	38.87	2320	34.48
1900	42.1	2064	38.75	2328	34.34
1904	42	2072	38.6	2336	34.24
1908	41.9	2080	38.43	2344	34.12
1912	41.83	2088	38.31	2352	33.98
1916	41.75	2096	38.16	2360	33.9
1920	41.66	2104	38	2368	33.78
1924	41.57	2112	37.87	2376	33.66
1928	41.48	2120	37.73	2384	33.53
1932	41.4	2128	37.58	2392	33.44
1936	41.31	2136	37.45	2400	33.32
1940	41.21	2144	37.31	2408	33.2
1944	41.15	2152	37.15	2416	33.11
1948	41.06	2160	37	2424	33
1952	40.93	2168	36.87	2432	32.89
1956	40.89	2176	36.75	2440	32.78

N°.	Links	N°.	Links	N°.	Links
2448	32.67	2712	29.5	2976	26.87
2456	32.57	2720	29.41	2984	26.8
2464	32.46	2728	29.32	2992	26.7
2472	32.36	2736	29.23	3000	26.66
2480	32.25	2744	29.15	3008	26.59
2488	32.15	2752	29.06	3016	26.52
2496	32.05	2760	28.98	3024	26.48
2504	31.95	2768	28.9	3032	26.38
2512	31 85	2776	28.81	3040	26.31
2520	31.75	2784	28.73	3048	26.25
2528	31.63	2792	28.65	3056	26.17
2536	31.53	2800	28.56	3064	26.11
2544	31.45	2808	28.48	3072	26.04
2552	31.34	2816	28.4	3080	25.97
2560	31.25	2824	28.32	3088	25.91
2568	31.15	2832	28.24	3096	25.83
2576	31.05	2840	28.16	3104	25.76
2584	30.95	2848	28.08	3112	25.70
2592	30.86	2856	28.01	3120	25.62
2600	30.76	2864	27.93	3128	25.57
2608	30.67	2872	27.85	3136	25.5
2616	30.57	2880	27.77	3144	25.44
2624	30.48	2888	27.7	3152	25.37
2632	30.38	2896	27.62	3160	25.31
2640	30.3	2904	27.54	3168	25.25
2648	30.21	2912	27.48	3176	25.18
2656	30.11	2920	27.39	3184	25.12
2664	30.02	2928	27.30	3192	25.06
2672	29.93	2936	27.24	3200	25
2680	29.85	2944	27.16	3208	24.93
2688	29.76	2952	27.1	3216	24.87
2696	29.66	2960	27.02	3224	24.81
2704	29.56	2968	26.95	3232	24.75

3240

N°.	Links	N°.	Links	N°.	Links
3240	24.68	3504	22.82	3768	21.23
3248	24.62	3512	22.77	3776	21.18
3256	24.57	3520	22.72	3784	21.13
3264	24.5	3528	22.67	3792	21.09
3272	24.44	3536	22.6	3800	21.05
3280	24.37	3544	22.56	3808	21
3288	24.32	3552	22.51	3816	20.95
3296	24.26	3560	22.46	3824	20.91
3304	24.21	3568	22.42	3832	20.87
3312	24.15	3576	22.35	3840	20.83
3320	24.09	3584	22.31	3848	20.78
3328	24.03	3592	22.26	3856	20.74
3336	23.98	3600	22.21	3864	20.7
3344	23.9	3608	22.17	3872	20.65
3352	23.86	3616	22.11	3880	20.6
3360	23.8	3624	22.07	3888	20.57
3368	23.75	3632	22.02	3896	20.53
3376	23.69	3640	21.97	3904	20.46
3384	23.63	3648	21.93	3912	20.44
3392	23.58	3656	21.87	3920	20.39
3400	23.53	3664	21.81	3928	20.35
3408	23.46	3672	21.78	3936	20.31
3416	23.4	3680	21.73	3944	20.28
3424	23.36	3688	21.69	3952	20.23
3432	23.31	3696	21.64	3960	20.19
3440	23.25	3704	21.6	3968	20.15
3448	23.2	3712	21.55	3976	20.12
3456	23.14	3720	21.5	3984	20.08
3464	23.09	3728	21.45	3992	20.04
3472	23.03	3736	21.40	4000	20
3580	22.98	3744	21.36	4016	19.92
3488	22.93	3752	21.31	4032	19.84
3496	22.87	3760	21.27	4048	19.76